

CESI SOURCEBOOK VIII

THROUGH the RAINBOW
CHILDREN, SCIENCE and LITERATURE

Compiled and Edited by
Audrey H. Brainard
Denise H. Wrubel

The Council For Elementary Science International

Through the Rainbow - Children, Science, and Literature

CESI Sourcebook VIII

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Preface

Each of us remembers experiences when reading a passage or a book motivated us to read more, to delve further, or to try something for ourselves. Such is the value of reading early and often. Parents and teachers encourage children to read by reading aloud to them, modeling, setting aside time, making a reading environment, offering books as gifts. With today's rich collection of children's science literature, science educators can encourage students' interest in reading and science by connecting the world of print with the world of hands-on experiences.

Children treasure books and they love hands-on science. This publication presents lessons that will nurture students' desire to read for pleasure and stimulate their interest in science concepts. The ideas presented through literature will lead children to investigate additional information, and motivate them to experience science experimentation.

Perhaps you will discover science lessons among your students' favorite literature. We invite you to enjoy *Through the Rainbow Children, Science and Literature*.

Barbara ten Brink
President, CESI 1994-1995

Introduction to *Through the Rainbow* *Children, Science and Literature*

Believing that children, science, and literature are a natural combination, this sourcebook was compiled as a framework for a literature-based approach to elementary science instruction. The articles in this book present ideas to help link science concepts with children's literature. With this approach, the literature and science become the core for inquiry as specific skills and activities are integrated in each topic area. The literature selected is intended to serve as a springboard to hands-on learning that incorporates critical thinking skills. This sourcebook provides a scaffold for teachers seeking to implement appropriate science learning experiences with literature.

Curriculum, instructional objectives, students' needs and learning styles, instructional settings, and available resources vary greatly from one instructional setting to another. Each individual teacher must determine which instructional activities are appropriate for a particular situation. Teachers are encouraged to select topics and modes of instruction that are relevant to the children's experiences and understandings at each grade level. **However, no matter what the particular instructional situation, teaching means helping students to understand, to remember, to use what is taught, and to become independent learners.**

Each topic presented includes:

- **Focus:** summarizes and explains the core science concepts and skills developed in the activities.
- **Challenge:** questions to motivate and stimulate learning.
- **Procedure:** to outline the key steps in performing the activities designed to develop the science concepts highlighted by the literature.
- **Assessment:** options for monitoring the learning.
- **Further Challenges** to encourage children to expand their learning and apply their knowledge to new experiences as well as to provide opportunities for children to learn about the innumerable applications of science to the world beyond the classroom.
- **Resources/References:** for added teacher support. This section often includes suggestions for related literature titles.

Audrey H. Brainard
Denise H. Wrubel

Children, Science, and Literature

1

Sink or Swim Stone Soup

by Stephanie A. McCartney

Materials and Equipment:

- recipe written on a chart.
- large pot. (I used a crock pot and let the soup simmer all morning)
- various vegetables contributed by students (chop and wash before activity), e.g., carrots, beans, potatoes, peas, celery. Precooked barley, though not a vegetable, is also good.
- stone (be careful of type) or large bone.
Wash and boil 2-3 hours before adding to the soup.
- beef broth
- bouillon cube
- water, amount depends on class size.
- sink or float prediction chart.
- bowls
- spoons
- crackers.
- brown (grocery) bag with a "?" printed on it.

Sample chart:

Ingredient	Sink	Float
Stone	X	
Carrots		X
Celery		
Potatoes		
etc.		

Q Are all vegetables alike?

Literature:

Stone Soup by Ann McGovern

Focus:

Students will be introduced to the concepts of sinking and floating. They will make predictions as to which vegetables and other items will sink or float in a pot of "stone soup."

Challenges:

What will happen when we put vegetables, etc., into our stone soup broth?

Why do some float and some sink?

Which vegetables float and which sink?

Which vegetable weighs the most? the least?

How are these vegetables the same: different? Sort the vegetables.

How do the vegetables grow? Where do they grow?

What part of the plant do they come from?

Procedure:

1. Begin with a class circle time. Ask, "Has anyone ever heard of stone soup?"

2. Play 20 questions. Have the stone or bone in the brown bag. Allow students to ask you 20 questions to determine what is in the bag. Discuss what it might be. (Many children will probably have heard the story.)

3. Read the story *Stone Soup*. At various points, stop and pull items from the story out of your pocket or the brown bag. Then ask the students if they would like to make stone soup.

4. Call the students to the "cooking area" and begin by reading the recipe together. Check for all supplies

5. Follow the first few directions; add broth, water & bouillon to the pot. Have children predict whether the stone will sink or float. Ask why? Mark prediction on the chart. Add the stone to the pot.

Continue in this procedure for the rest of the ingredients: Predict and mark the chart, test, etc. Allow the children to add the ingredients.

6. Stop at various points and question why some floated and others didn't. Discuss the weight of pieces of the vegetables of a given size.

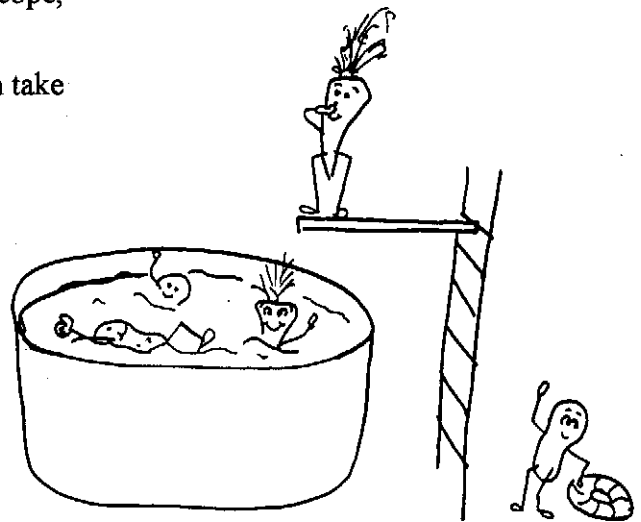
7. Look at the vegetables with a handlens, pocket microscope, or stereoscope to look for any differences in structure.
8. Allow the soup to simmer. When ready, have children take another look. Are the same vegetables still floating?

Assessments:

- Assessment can be done throughout the lesson by questioning on different levels.
- A "K-W-L" chart can be used throughout the lesson.

Sink or Float

K	W	L
what we know	what we want to find out	what we learned



Further Challenges:

- Enjoy the soup or donate it to a homeless shelter.
- Give the students crackers for their soup. Have them predict if they will float or sink?
- What fruits will float and sink? Encourage children to try other items in water and record the results.
- Put pepper in water in a pie pan. Drizzle dishwashing liquid down the side. What happens?
- Have students design their own boats. Have a boat race.
- Experiment with fruits and vegetables in salt water.
- Eat vegetables raw and compare with the cooked vegetables in the soup.

Resources/References:

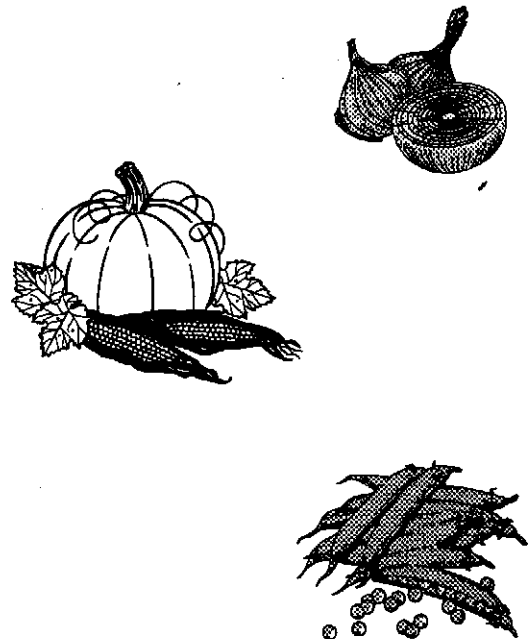
Children's Books:

Allen, P. (1983). *Who Sank the Boat?* Coward.
 Lionni, L. (1986). *Swimmy*. Scholastic.
 McGovern, A. (1963). *Stone Soup*. Pantheon.

Teachers' Books:

Delta Science cards for Sink and Float
Simple Science Experiments. (1987). Evan-Moor Corp.
Mailbox Magazine, Primary level, Jan/Feb 1989.

Q Where and how do vegetables grow?
 What part of a plant was each vegetable while it was growing?



The Author:

Stephanie A. McCartney, teacher Lower Merion School District, Blue Bell, Pennsylvania.

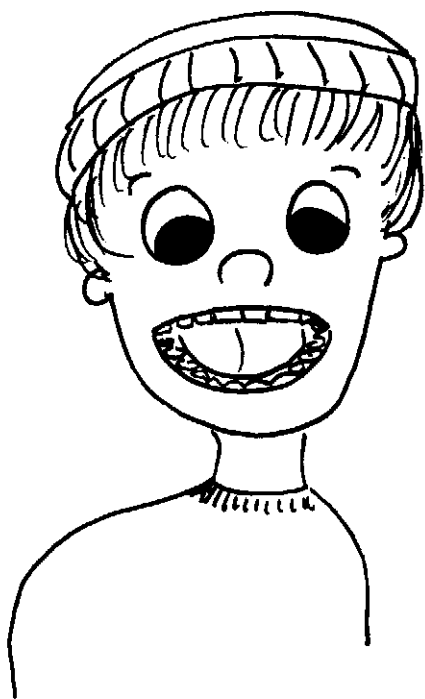
2

Chompers

by Don Nelson

Materials and Equipment:

- "sticky" notes (two colors)
- small mirrors
- crayons or markers



Literature:

Lunch by Denise Fleming

Focus:

Nothing motivates kids like eating! Why not use teeth to learn more about individual differences through this high interest data collection activity?

For us to utilize the energy stored in the plants and animals we eat, our food must be broken down and digested. The process of digestion begins in the mouth with the teeth. Our teeth are designed to consume a variety of foods; the incisors cut, the canines and bicuspid tear, and the flat-topped molars grind and crush. As our teeth break food into smaller bits, saliva coats each piece and begins the chemical process of digestion.

Children usually have twenty temporary ("baby") teeth that are replaced by permanent teeth beginning at about the age of seven. While adults are expected to have thirty-two teeth, a large percentage of American adults have fewer than that because of the common dental practice of removing "wisdom" (3rd molars) teeth.

Challenges:

How many teeth do you have? Do other people have the same number of teeth as you? Do children and adults have the same number of teeth? What is the most common number of teeth in our class, our school, and our families?

What do our teeth do for us?

Why should we care for our teeth?

Procedure:

Students work in pairs during the in-class portion of the activity. It might be best if several pairs worked together to gather tooth data from other classrooms. A take-home survey could be used to collect family tooth information.

1. Read and discuss *Lunch* by Denise Fleming.

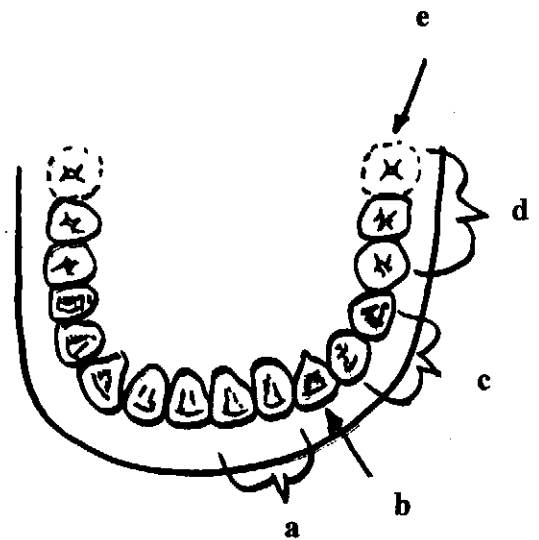
- How would you describe Mouse's eating behavior? Did he have good eating manners? Why do you think so?
- Mouse ate vegetables and fruit. What is the difference between fruits (part of a plant containing seeds) and vegetables (part of a plant that does not contain seeds)?

- Why didn't Mouse look for meat to eat?
- What other sayings about animals and eating have the students heard?
- Would the students like to join Mouse for lunch?
Which foods shown in the book would they eat first? Last?

2. Give each student a sticky note and ask them to, without counting, predict the number of teeth they have in their mouth.
3. At the board, the student stick up their notes to create a bar graph. Discuss the graph with them.
4. Discuss teeth. Ask students:
 - How many teeth do you have?
 - How could you find out?
5. Using mirrors or their tongue, the students count how many teeth they actually have. They write this number on a different color of sticky note and make a new bar graph.
6. Compare the two bar graphs.
7. Identify the different types of teeth the kids have: a) incisors, b) canine, c) bicuspids, d) molars, and maybe e) wisdom and the job that each type of tooth does.
8. Using mirrors, pencils, and crayons the students draw and label a "map" of their mouths.
9. Have the students conduct surveys of the other classes in the school and of their families. Besides number of teeth, the students could collect data on other variables such as age and gender.
10. The collected tooth data could be compiled in both chart and graph formats.
11. Have the students analyze the data and develop generalizations based on their findings.
12. Students should report the results and conclusions from their tooth survey activities in the school newspaper or in a take home report for their families.

Assessments:

- Using the generalizations generated from their analysis of the collected data, students should be able to make predictions about unsurveyed populations by correlating number of teeth with the individual's age.
- Older students should be able to apply the statistical terms mean, median, and mode to other normally distributed data.



Q Does everyone have the same number of incisors?

Q Which teeth do you use the most when eating steak?

Q Is it possible to bite into an apple without using incisors?

Further Challenges:

- Compare human teeth to animal teeth using skulls or pictures of skulls. How are animals' teeth adapted to their diets?
- Students can practice eating some different types of foods and pay attention to the teeth they use while eating. Apples, crackers, bagels and carrots work well with this activity.
- Students can make tooth casts by biting into clay and filling the depressions with Plaster of Paris.

Resources/References:

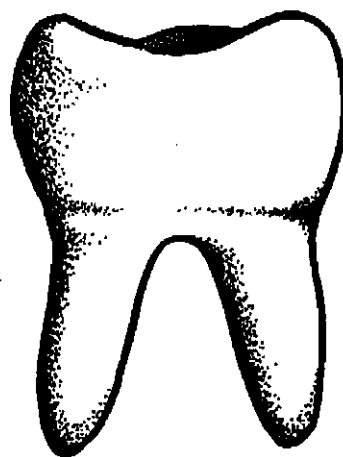
Children's Books:

- Bate, L. (1975). *Little Rabbit's Loose Tooth*. New York: Crown.
- Birdseye, T. (1988). *Air Mail to the Moon*. New York: Holiday House.
- Brown, M. (1985). *Arthur's Tooth*. New York: Little Brown.
- Cooney, N.E. (1981). *The Woobly Tooth*. New York: Putnam.
- Fleming, D. (1992). *Lunch*. NY: Henry Holt and Company.
- Hoban, L. (1985). *Arthur's Loose Tooth*. New York: Harper & Row.

Teachers' Books:

- Buffington, K., Ecklund, J., Mercier, S. & Wiebe, A., (Eds.). (1987). *Fun with Foods*. Fresno, CA: Aims Education Foundation.
- Ecklund, J., Hillen, J., & Wiebe, A. (Eds.). (1987). *Jaw Breakers and Heart Thumpers*. Fresno, CA: Aims Education Foundation.

The Author: Don Nelson, Ph.D., Western Illinois University
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"Egg" Plants

by Don Nelson

3

Literature:

How a Seed Grows by Helene J. Johnson

Focus:

Seeds contain the embryo of a plant along with the necessary stored nutrition to provide for the seeds' needs until it emerges from the soil (or as a student succinctly put it, "A seed is a baby plant in a box with its lunch.") Seeds consist of a seed coat, an embryo (the dormant plant with root, stem and leaf structures) and stored food (cotyledon). During the process of germination, the seed swells and the embryo's root, stem and leaf emerge through the seed coat. The conditions necessary for seed germination are moisture and warmth.

When the seed breaks through the soil into the sunlight, it can begin to produce its own food. To make its food (sugar), plants must take in water and minerals from the soil and combine these ingredients with chlorophyll, the plant's green pigment, utilizing sunlight as energy. Green plants are the only organisms capable of producing food and are the basis of the food pyramid that supports all other organisms. The conditions necessary for proper plant growth and development are water, minerals, soil, sunlight and warmth.

The mysteries of life surround young children. What is alive? Why do things die? How are other living things like me? Germinating seeds and growing plants in egg carton chambers offer your students the opportunity to explore such questions in the classroom setting.

Challenges:

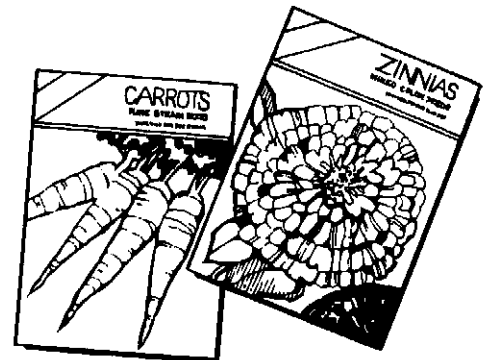
What does it mean when a seed germinates? Do all seeds germinate in the same way at the same rate? What do seeds need to germinate? Can you grow a garden in an egg carton?

Procedure:

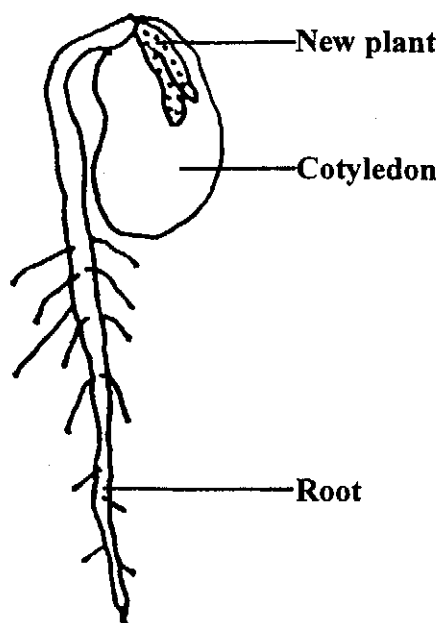
1. Explore gardens. Ask the students: How many of you have gardens at your house? Did you help plant the garden? What did you plant in your garden? How do the seeds you put in the soil become plants? What is needed for a seed to become a plant? What is needed for plants to grow?
2. Read *How a Seed Grows* by Helene J. Johnson. Have kids bring in different types of seeds. How many different kinds of seeds can they collect and identify for a class seed collection. Do roots always grow down? What would happen if you

Materials and Equipment:

- styrofoam egg cartons
- a variety of garden seeds
- paper towels
- potting soil
- tooth picks
- pen with permanent ink
- magnifiers



Q Can you think of other books that tell about planting seeds and growing plants?



Q What does a germinating seed look like?

removed a germinating seed and turned it around so the root was going up? Why don't all seeds germinate? The book's author indicates that soil, water, and sun are all needed for a seed to grow. Is that true? How could you find out?

3. Students should work in groups with each group receiving an egg carton and selection of seeds.

4. Give each group a styrofoam egg carton.

- Using scissors, they cut off the "bumper" located in the middle of the carton's top.
- Students fold two paper towels lengthwise so they will fit through the slot in the carton where the bumper was removed.
- Give students large glasses of water. They soak the folded paper towels in the water and pull both towels half way through the bumper slot.
- Separate and lay the paper towels down in the lid on either side of the slot.
- Set the egg carton on top of the glass of water so that the other ends of the paper towels hang in the water
- Each group takes another paper towel and folds it so it fits snugly in the top of the egg carton.
- The students divide this towel into eight equal sections using a pencil and a ruler and lay it on top of the two folded wet towels.
- Make available at least eight different types of garden seed.
- Students use a permanent ink pen to label their paper towel with the names of the seeds they selected, one name per section.

5. Wet the labeled paper towel, lay inside the top of the carton and place equal numbers of each type of seed in the labeled section. Lay a second wet towel on top of the seeds and close the carton.

6. Have students predict the order in which they think the seeds will germinate.

7. Check daily for germinating seeds. Students keep records of the germination and development of their seeds.

8. Did all of the seeds germinate? Which seeds were most likely to germinate? Least likely? What factors may explain why some seeds germinate quickly while others perhaps did not germinate at all? What did seeds need to germinate?

Assessments:

- Have the children identify the conditions needed for seed germination. Have the children identify the conditions needed for plant growth.

- Soak lima beans over night. Students dissect the seeds using tooth picks. Can the students find and identify the seed coat, cotyledons and embryo?

Further Challenges:

- When the egg carton seeds have germinated, add soil to the cartons and label the seeds with signs made from toothpicks and paper.
- Plant seeds in eggshells. Observe how the plants' roots will eventually break the egg shells.
- Start a sponge garden. Put fast growing seeds (alfalfa, mung bean or water cress) in the holes on top of a wet sponge placed in a container lid. Wet the sponge daily by placing it in water.
- Grow a mighty oak tree. Find a sprouting acorn and place it on top of a test tube with the root pointing down. Measure the roots, trunk and leaves as they develop.

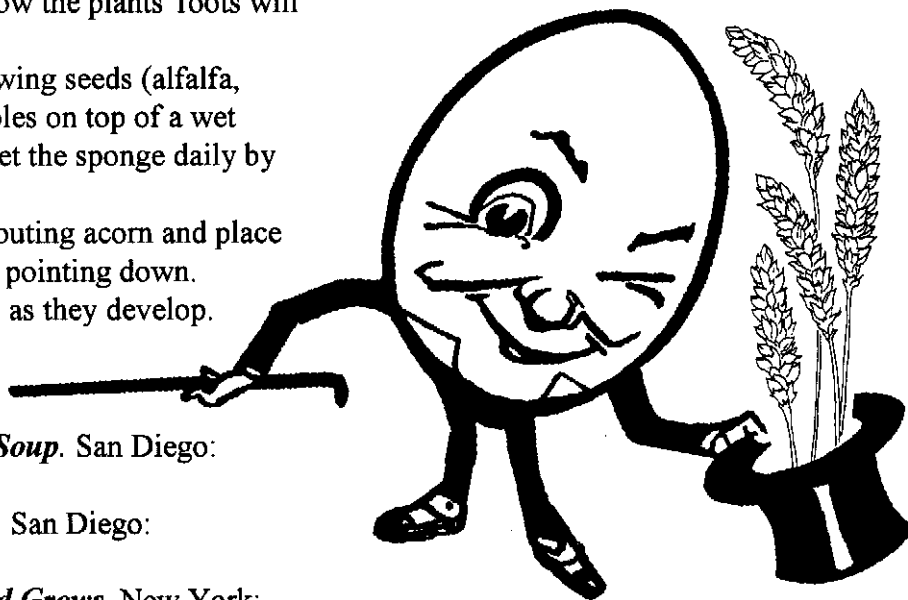
Resources/References:

Children's Books:

- Ehlert, L. (1990). *Growing Vegetable Soup*. San Diego: Harcourt Brace Jovanovich.
- Florian, D. (1991). *Vegetable Garden*. San Diego: Harcourt Brace Jovanovich.
- Jordan, H. (1960 & 1992). *How a Seed Grows*. New York: Harper Collins.
- Kraus, R. (1945). *The Carrot Seed*. New York: Harper and Row.

Teachers' Books:

- Cohen, J. & Pranis, E. (1990). *Grow Lab*. Burlington, VT: National Gardening Association.
- Ecklund, L., Hillen, J., & Wiebe, A., editors. (1984). *Spring into Math and Science*. Fresno, CA: AIMS Education Foundation.
- Hillen, J., & Hoover, E., editors. (1990). *Primarily Plants*. Fresno, CA: AIMS Education Foundation.
- Marson, R. (1989). *Green Thumbs*. Canby, OR: TOPS Learning Systems.



The Author:

Don Nelson, Ph.D., Western Illinois University

4

Big Beans, Little Beans

by Carol Nichols

Materials and Equipment:

- small containers such as:
paper cups or margarine tubs
- soil
- assorted bean seeds
- growth chart:
- masking tape
- construction paper

Q Do all bean seeds grow at the same rate?

Literature:

Jack and the Beanstalk retold for Lucky Book Club

Focus:

Most plants grow from seeds. Planting seeds help children understand how a plant develops. Very young children can easily grow and take care of plants at school or home.

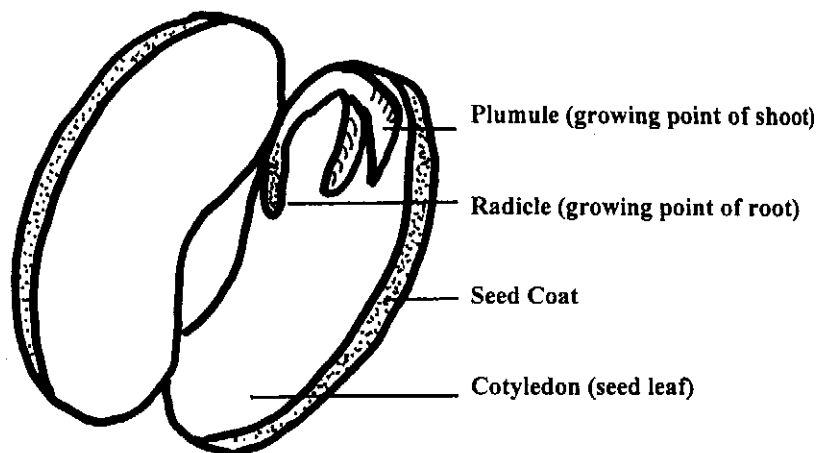
Challenge:

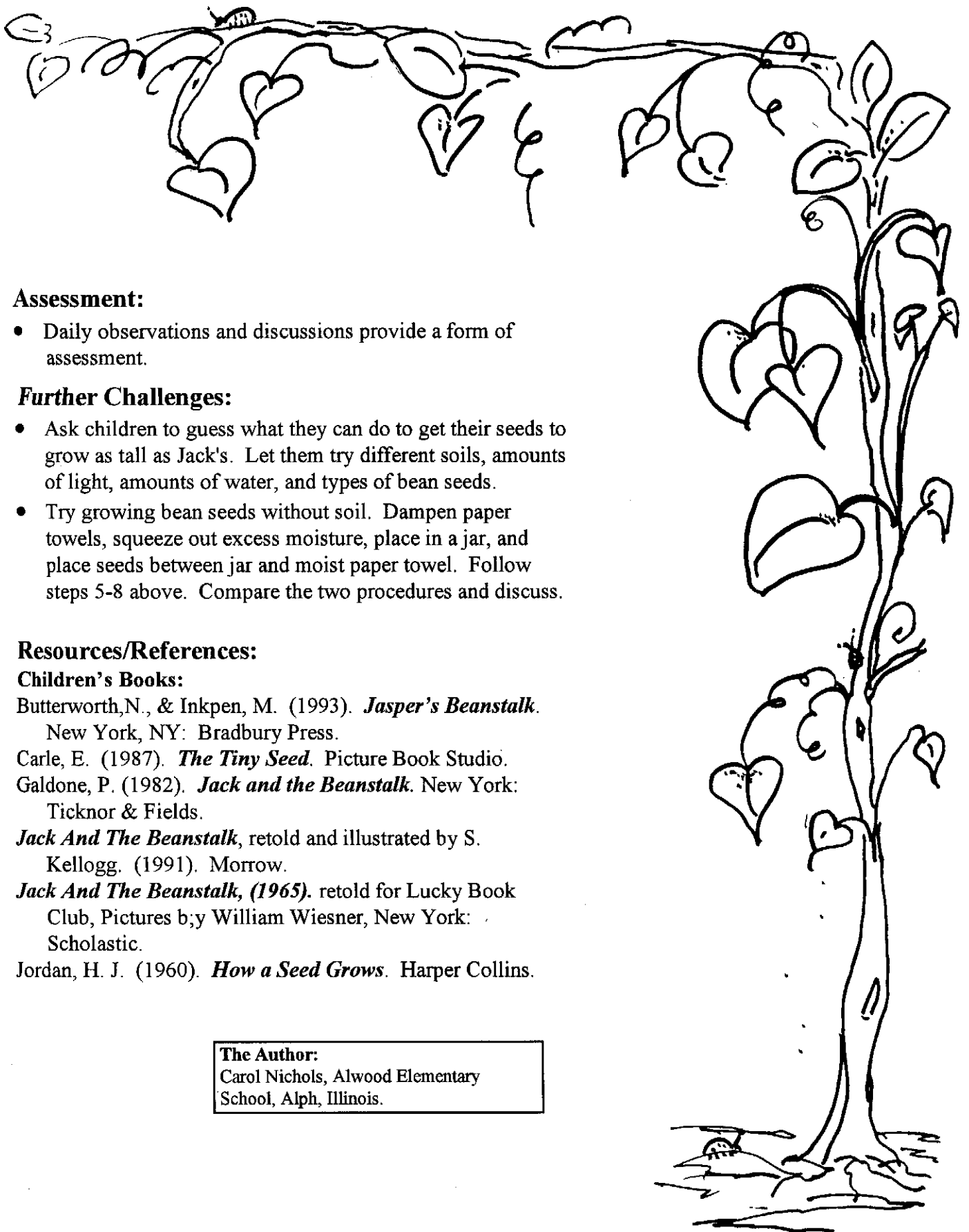
Can we grow a bean plant as tall as Jack's bean plant?

Procedure:

1. Read *Jack and the Beanstalk*.
2. Fill containers with soil
3. Plant seeds by pushing into the soil and covering any holes.
4. Water soil - moist but not soaking.
5. Place containers in sunny window. Keep soil moist.
6. Have the class decide if they think their bean plants/beanstalks will grow as tall as Jack's. Mark correct side of a yes/no graph.
7. Check plants daily. Make a growth chart. Note the date the seed is planted, the date the plant appeared, and the date the plant didn't grow any further. The children can measure the height of their plants with strips of masking tape that can be placed on paper to keep a daily record of growth. Children might also illustrate the changes in their plant.
8. Discuss changes in the plants as they occur..

Bean Seed





Assessment:

- Daily observations and discussions provide a form of assessment.

Further Challenges:

- Ask children to guess what they can do to get their seeds to grow as tall as Jack's. Let them try different soils, amounts of light, amounts of water, and types of bean seeds.
- Try growing bean seeds without soil. Dampen paper towels, squeeze out excess moisture, place in a jar, and place seeds between jar and moist paper towel. Follow steps 5-8 above. Compare the two procedures and discuss.

Resources/References:

Children's Books:

- Butterworth, N., & Inkpen, M. (1993). *Jasper's Beanstalk*. New York, NY: Bradbury Press.
- Carle, E. (1987). *The Tiny Seed*. Picture Book Studio.
- Galdone, P. (1982). *Jack and the Beanstalk*. New York: Ticknor & Fields.
- Jack And The Beanstalk*, retold and illustrated by S. Kellogg. (1991). Morrow.
- Jack And The Beanstalk*, (1965). retold for Lucky Book Club, Pictures by William Wiesner, New York: Scholastic.
- Jordan, H. J. (1960). *How a Seed Grows*. Harper Collins.

The Author:

Carol Nichols, Alwood Elementary
School, Alph, Illinois.

5

Bagging a Branch (or When Do Weeping Willows Weep?)

by David R. Stronck

Materials and Equipment:

- long, clear plastic bags used to protect newspapers from rain or any clear plastic bag that can hold at least one quart or one liter of air volume. All of the bags should be identical.
- twist and seal (covered wire strip for sealing bags)

Q How will sunshine and temperature affect the results?

Literature:

The Almond Orchard by Laura Jane Coats

Focus:

Plants must take up water from their roots. Without adequate water plants wilt and die. Plants give off (transpire) water from their leaves. A forest may give off by evaporation the same amount of water per acre that evaporates from an open body of water, e.g., a lake or the ocean. The huge loss of water from plants occurs through open stomates, i.e., pores in the leaves. The plants must open their stomates to allow carbon dioxide gas to enter the interior of the leaves. The carbon dioxide gas is needed to do photosynthesis.

Unfortunately for the plant, the loss of water happens whenever the stomates are open. Desert plants survive in hot, dry climates because they open their stomates at night when the temperatures are cool.

Challenge:

How can we discover how much water plants give off?

Procedure:

1. Read and discuss *The Almond Orchard*.
2. Start this activity early on a warm, sunny day. Each child will place a plastic bag over the tip of a branch enclosing as many leaves or needles as possible. Allow the bag to be loosely full of air. Gather the opening around the branch and seal off the end with a twist and seal. The students could note the conditions of shade and of temperature at the location.
3. After at least one hour, have the children observe any changes inside the bag. Droplets of water may form over the entire inside surface of the bag. The students should record changes in the conditions of shade and of temperature. Children should continue to visit the bags at one hour intervals and note any water inside the bags. The children should easily conclude from their observations that plants give off much water into the air.
4. Remove the bag. Measure the amount of water collected in each bag. Measurement of the amount of water allows a quantitative ranking of the various samples, ranging from leaves that give off much water to those that give off little or

no water. Students can measure the amount of water that they recover. A simple way of measuring the amount is to use eye droppers and count the number of drops. Please note that it is important to use identical eye droppers since various droppers may give a wide range of drops per milliliter. A graduated cylinder may also be used.

5. Ask the children to explain why some bags contain more water than others. Probably a plastic bag placed over the leaves of a deciduous plant in the sunshine will contain much water, perhaps as much as 10 ml or a couple of tablespoonfuls. On the other hand, a bag placed over many plants in the shade or over some specialized plants such as cactus, will show little or no water. Their data will demonstrate that sunlight and higher temperatures increase the amount of water that can be recovered in the plastic bags.

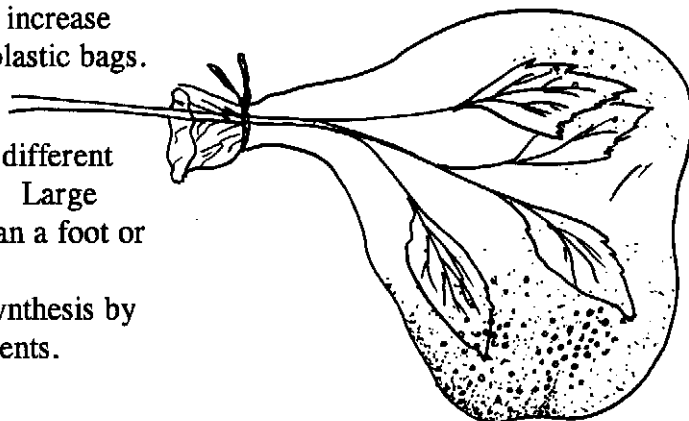
Further Challenges:

- Student can select different plants, or at least a different part of a tree or a shrub and repeat the activity. Large flowers or weeds (i.e., plants standing more than a foot or 30 cm in height) may also be selected.
- Students may wish to study more about photosynthesis by reading various books and doing other experiments.

Resources/References:

Children's Books:

- Althea. (1990). *Trees and Leaves*. Mahwah, NJ: Troll Associates.
- Coats, L. (1991). *The Almond Orchard*. New York: Macmillan Publishing.
- Fowler, A. (1990). *It Could Still Be a Tree*. Chicago: Childrens Press.
- Hiscock, B. (1991). *The Big Tree*. New York: Atheneum.
- Jennings, T. (1990). *Trees*. New York: Watts/Gloucester.
- Kuhn, D. (1990). *More Than Just a Flower Garden*. Englewood Cliffs, NJ: Silver Press.



The Author

David R. Stronck, Ph.D. is a Professor of Science Education at California State University, Hayward.

6

Perfect Pancakes

by Betty Crocker, Edward L. Shaw, Jr. and Barbara Reed

Literature:

Pancakes for Breakfast by Tomie dePaola.

Pancakes, Pancakes by Eric Carle.

Focus:

Students will be able to:

- make accurate capacity measurements.
- identify manipulated, responding, and controlled variables,
- predict and test the results of manipulating a variable.

Challenge:

What effect does milk type have on the appearance, cooking speed, and taste of pancakes?

Advance Preparation:

Place baking mix into containers students can easily handle such as butter tubs. Label each container either A, B, C, or D.

Pour milk into containers students can easily handle such as small plastic bottles. Label each container either A (heavy cream, B (half-&-half), C (whole milk), or D (skim milk).

Procedure:

1. Ask students what relationship exists between cooking pancakes and science variables. Discuss the variables when making pancakes, then decide to test the effects of different types of milk on pancakes. Have students predict or decide if different types of milk will have an impact. If they think it will, have them predict some ways the pancakes will be affected.
2. Divide your class into teams of 4 with specific jobs such as:
 - collect supplies and measure milk;
 - direct steps and measure baking mix;
 - stir and direct clean-up;
 - measure batter for cooking and time cooking.

Consider having a meeting of all number 1 students to clarify their role. Then meet briefly with the 2s, etc.

Assign each group a letter - A, B, C, or D. Groups will receive containers of milk and baking mix marked with their letter. There is no problem with having more than 1 Group with each letter

Materials and Equipment:

Per Class:

- all-purpose baking mix
- 4 types of milk - cream; half-&-half; whole milk; skim milk
- transparency of directions/recipe
- baking mix container for each group
- milk container for each group
- cooking surface
- spatula
- paper plates

Per Group:

- small mixing bowl
- egg
- fork or spoon for mixing
- a watch with a second hand
- 125 ml wet-measuring cup
- 125 ml dry-measuring cup
- 15 ml measuring spoon

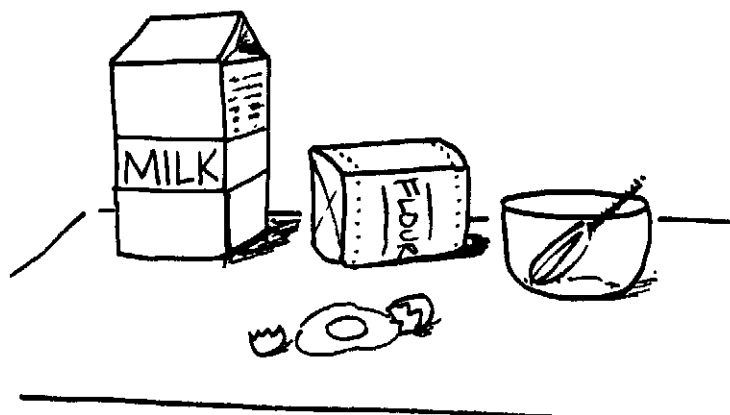
Prepare direction transparency:

- 1 egg, beaten;
- 125 ml milk, added to the egg and mixed;
- 125 ml baking mix, stirred into egg/milk until moistened

3. Distribute materials. Give each group milk and baking mix in containers with matching labels (A milk & A mix). Have students follow the recipe to prepare pancake batter.

4. Have groups rotate around the room and examine each type of batter, A - D. Look for similarities and differences in the batters. Ask students:

- How are the batters alike? Why? How did you decide?
- How are the batters different? Why? How did you decide?
- What did we change from group to group (manipulated variable)? Could you tell? How?
- What did we keep the same in all groups (controlled variables)? Could you tell? How?
- How many silver dollar-sized pancakes do you think each batter (A - D) will make? Will each make the same number?
- Will we be able to tell pancakes from one batter from another (responding variable)? Why do you think so?



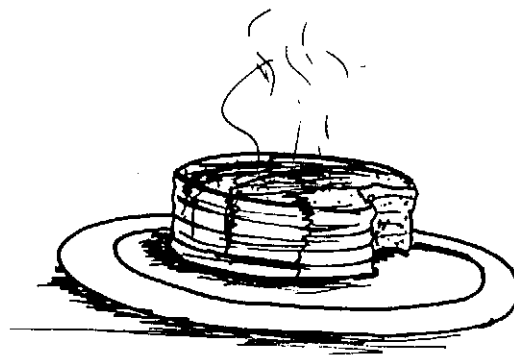
5. Have the teacher cook one pancake from each batch at the same time in the same pan. Assign each batch a spot in the pan. Cook all the pancake batters in their assigned area of the pan. Use a timing device to measure the cooking time. Record the cooking times for each type.

6. Give each student each type of pancake. You may need to cut pancakes to have enough for each student. Compare pancakes from each type of batter. Observe similarities and differences.

7. Ask students:

- Did each type of pancake cook at the same speed?
- What did you notice as the pancakes cooked? Did all the types act the same as they cooked? How were they alike? Different?
- Did the cooked pancakes look the same? Taste the same? How were they alike? Different?
- What do you think caused the differences you noticed?

Q How are batters alike?
How are batters different?



Q How long does it take to make pancakes?

In *Pancakes for Breakfast* by Tomie dePaola a little old lady's attempts to have pancakes for breakfast are hindered by a scarcity of supplies and participation of her pets

In *Pancakes, Pancakes* by Eric Carle, By cutting and grinding the wheat for flour, Jack starts from scratch to help make his breakfast pancakes.



The Authors:

Betty Crocker, Ed.D., University of North Texas, Denton.

Edward L. Shaw, Jr., Ed.D., University of South Alabama, Mobile.

Barbara Reed, Ed.D., Gwinnett County School, Lawrenceville, Georgia.

- Which pancake did you prefer? Why?

8. Read a children's book about pancakes after pancakes have been made in class. As you read, compare the events in the story to the activity from class. Two possibilities are:

Pancakes for Breakfast or *Pancakes, Pancakes*.

9. Discuss how their pancake experience compared to the one in the book they read. How was it different? What could they do to make their experience more like the one in the book? How could they rewrite the book to make it more like their pancake experience?

Assessments:

- Listen to class and small group discussions about the pancakes they cooked and the book read.
- Listen to class and small group discussions about rewriting the book or altering their pancake experience.
- Let students generate statements about the relationship between type of milk used and pancake appearance and taste.

Further Challenge:

- Discuss other pancake ingredients we could test for an effect.
- Do different brands of a mix make a difference?
- Does a low-fat mix make a difference?

Resources/References:

Children's Books:

dePaolo, T. (1978). *Pancakes for Breakfast*. New York: Harcourt: Brace, Jovanovich.

Carle, E. (1990). *Pancakes, Pancakes*. Saxonville, MA: Picture Book Studio.

Teachers' Books:

Crocker, B., Shaw, E. and Reed, B. (1994). *Processing Pancakes, Food for Thought and Learning: Edible Process Skills*. Florida: Riverside, Idea Factory.

Any basic cookbook with a recipe for pancakes made from scratch may be substituted instead of a baking mix. This allows for testing the effect of other ingredients.

Flannel Board Pictures Made Easy

by Janet Bendell and Bonnie Gentesse

7

Procedure:

The interfacing is placed over any picture and the picture is then traced onto the material. After coloring with crayons or markers, the picture is cut out. If crayons are used it is advisable to press the interfacing pieces to "set" the crayon and remove excess wax. To "set" the crayon press by placing the pieces of interfacing between 2 sheets of newspaper and pressing with a medium hot iron for a few seconds. Interfacing pieces "stick" well to flannel boards and are very easy to make.

This activity provides working parents, who want to help but can not come to school during the day, an opportunity to do something for the classroom on their own time. It is easy to demonstrate how to do the pieces during parent conferences or PTA PTO Meetings. Once a parent has completed a story for the class their child becomes the helper when the teacher reads the story to the class.

This method of making pictures can be used to illustrate an entire book. Later the students can retell the story by placing the interfacing pieces on a flannel board. Using interfacing pieces can be used for sequencing the story line.

This is a great way to reinforce some concepts in science such as when teaching parts of a flower or the water cycle. After having learned a concept students can place the pieces on the board in the correct position or sequence.

It can be used for a mathematics lesson. Make any number of objects such as different colored ice cream cones. Place them on the flannel board and ask, "Which cone is third? Which cone is the last one in the second row?"

Let your imagination run wild!

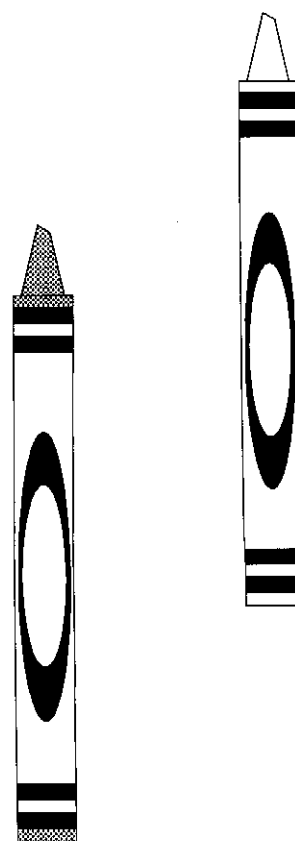
Materials and Equipment:

Interfacing-a non-woven stiffening material that is available at fabric stores.

One brand is Pellon stabilizer. The best type is non iron-on for a midweight for heavy weight fabrics.

Felt markers or crayons

Books or pictures



Authors:

Bonnie Gentesse, Kindergarten Teacher,
Washington School, Union, NJ

Janet Bendall, Kindergarten Teacher,
Livingston School, Union, NJ

8

Mitten, Mitten, How Much in the Mitten?

by Pat Bowers

Materials and Equipment:

- miscellaneous small objects such as nuts, bolts, Unifix cubes, two-sided place markers, beans, marbles, plastic milk lids, etc.. These should be divided into boxes or plastic bags for easy distribution. Each container should have more than the number of objects than will fill the paper mittens.
- staplers
- scissors
- crayons or markers (optional: to decorate paper mittens if desired)
- activity sheet with outline of mittens, one sheet per student

Q Which version of *The Mitten* do the students like best? Why?

Q How big would a mitten have to be to hold the animals in the story?

Literature:

The Mitten a Ukrainian Folktale by Jan Brett

The Mitten by Alvin Tressett

Focus:

This activity is designed to develop an understanding of the concept of volume. It also develops an understanding of the scientific method and such process skills as communicating, predicting, using numbers, controlling variables, interpreting data, inferring, and defining operationally.

There are several terms you might want to use when using this unit. Matter is anything that has mass and takes up space.

Volume is a physical characteristic of matter and is defined as the space occupied by an object. A prediction is speculation of what will happen in the future based on past experiences.

Predictions (as opposed to guesses) are based on observations, previously collected data, measurements, and inferences about relationships between or among observed variables.

Challenge:

How accurately can you predict the volume of a paper mitten?

Procedure:

1. Read one or both versions of *The Mitten* to the students.
2. Discuss the major points so students know the basic characters, sequence of activities, plot, and climax to the story.
3. Ask the students if all the animals in the story could really fit into the mitten. Develop the idea of real and not real as needed. Then tell them they are going to see how many objects they can put in a mitten.
4. Students should be in cooperative groups of four, with the jobs being materials manager, constructor, counter, and recorder-reporter. At the lower grades, you may want to determine the cooperative groups so that there is at least one student who can count well in each group. The materials manager needs to get scissors, a copy of the mitten pattern, and at least two sets of different kinds objects. The number of objects will vary according to the size; each group should have enough of each set of objects to more-than-fill the mitten. The same object should be given to at least two groups so that

predictions and the actual number of objects that filled a mitten can be compared later on. (For younger children, you will want to try to use slightly larger objects so they don't have to count as high.)

5. The constructor in each group should cut out and staple a mitten, being sure to leave the straight edge of the mitten open so objects can be placed in it.

6. Before filling the mittens, the groups should predict how many of the first set of objects will go in their mitten. The recorder should record their prediction on their group chart. (Make sure the students know the difference between guesses and predictions.) Repeat with the other objects.

7. After predicting, the counter should fill the mitten with the objects, counting the objects as they go into the mitten. The counting can be by 2's, 5's, 10's, etc. if students are working on these skills. Record the actual number of objects it took to fill the mittens on the chart.

8. Determine the difference between the predicted and actual number of objects that filled the mittens. For older children, you will actually add and subtract, possibly coming up with a positive or negative number depending on the prediction. For younger children, the concepts of "greater than" and "less than" are sufficient for the difference.

9. After counting the first set of objects, the groups may revise their previous predictions as needed. Do NOT erase the first prediction. Circle it and then write in the new prediction based on what was learned from the filling of the mitten with the first object.

10. When each group is finished with its objects, the recorder-reporter should record their results on a class data chart.

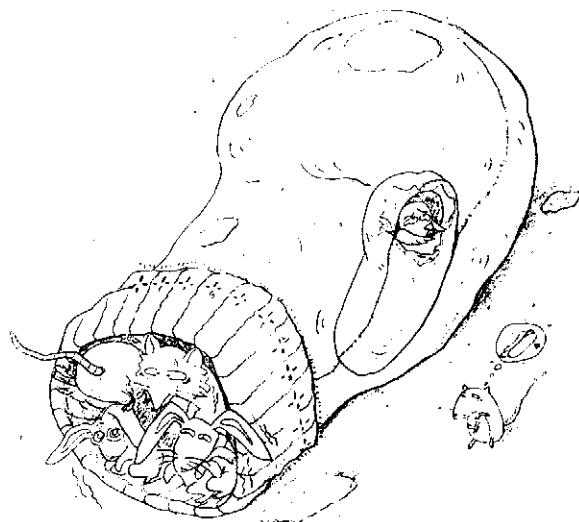
11. The data chart might look something like the one to the right. Discuss the differences between the predicted and actual results to determine the factors that affect the results of the activity.

12. Discuss the factors that affect the results, recording their ideas. Ask the students:

- Why they think there were differences between the predicted and actual numbers?
- Why they think there were differences even though groups were using the same objects?
- For older students, you will want to develop the concept that the definitions, types of materials used, and methodology all can make a difference in the results. This would include such factors as their definition of what "full"

Have each group make a chart with the following headings:

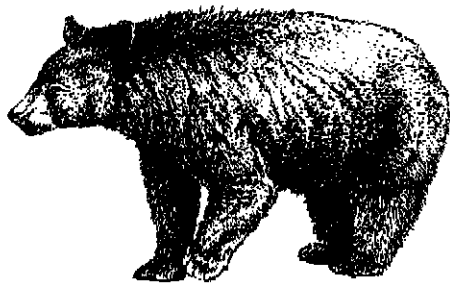
Object	Predicted Number	Actual Number	Difference
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Data Chart

Objects	Predicted Number	Actual Number	Difference
marbles	50	97	47
marbles	100	183	83
bolts	100	119	19
bolts	300	149	151

(and so on, using beans, soda can tab tops, two-sided place markers, etc.)



is, the size and shape of the objects, the compressibility of the objects, how far from the edge the mitten is stapled, whether they shake their mittens as they fill them, etc. Use science terms and the science process skills as appropriate.

- For younger students you may just want to discuss variables that made a difference without going into more detail.

Variables (things that made differences)	Science Term
Where you staple the paper mitten	methodology
What you consider to be "full"	operational definition
Shape of the object	properties of objects
Texture of object	properties of objects
If you shake the objects so they settle	methodology
Size of the mitten	properties of objects
What the object is made of (<i>This question can lead to a discussion of the compressibility of the object</i>)	properties of objects
What the mitten is made of (<i>This question can lead to a discussion of the elasticity of the mitten—the container</i>)	properties of objects



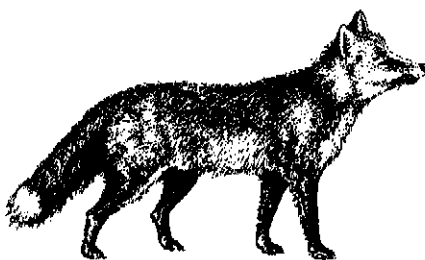
13. Introduce the term volume and apply it to the activity. Make sure students understand that the capacity of an object is determined by its volume, but it is also affected by other variables such as those discussed above. This concept can be developed and extended based on the developmental level of the students as well as their previous knowledge.

14. The students can repeat the activity, but this time they should decide on methodology and control the variables.

Further Challenges:

Some other science topics that could be developed after reading the story *The Mitten* and doing this activity are:

- Venn diagram sorting activities with mittens
- Winter, seasons
- Dressing for different seasons
- Heat, temperature
- Density
- Habitats/Biomes
- Food chains
- Animals, mammals (including contrast with other types)
- Collecting data and interpreting it
- Research one of the animals in the stories
- Classify animals in stories



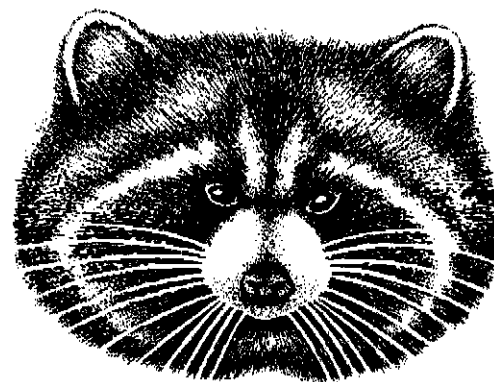
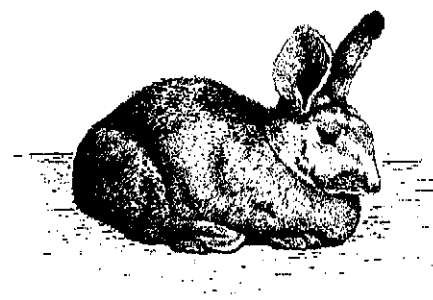
Resources/References:

Children's Books:

- Andersen, Hans Christian *The Snow Queen*. (folk tale)
- Burton, Virginia Lee (1943). *Katy and the Big Snow*. Boston: Houghton Mifflin.
- Gardiner, John R. (1983). *Stone Fox*. New York: Harper.
- Livingston, Myra Cohn (1982). *A Circle of Seasons*. New York: Holiday House.
- Morgan, Allen (1985). *Sadie and the Snowman*. New York: Scholastic.
- Munsch, Robert (1985). *Thomas' Snowsuit*. New York: Annick.
- Preelutsky, Jack (1983). *Random House Book of Poetry for Children* (four seasons section). New York: Random House.
- Stwertka, Eve & Stwertka, Albert (1991). *A Chilling Story: How Things Cool Down*. New York: Julian Messner/Simon Schuster.

Teachers' Books:

- Allison, Linda (1975). *The Reasons for Seasons*. Boston: Little, Brown.
- Chien, Tik L. (1981). *Invitations to Science Inquiry*. Chino Hills: Science Inquiry Enterprises.
- Mandell, Muriel (1959). *Physics Experiments for Children*. New York: Dover.
- McCracken, Marlene and Robert (1987). *Winter*. Winnipeg, Canada: Peguis Publishers, Ltd.
- National Wildlife Federation. (1989) NatureScope: Wild About Weather (Washington: National Wildlife Federation)
- Polman, Marvin N. and Morton, James (1986). *Earth Science Activities for Grades 2-8*. West Nyack, NY: Parker.
- Polman, Marvin N. and Morton, James (1986). *Physical Science Activities for Grades 2-8*. West Nyack, NY: Parker.
- VanCleave, Janice Pratt (1989). *Chemistry for Every Kid*. New York: John Wiley & Sons.
- VanCleave, Janice Pratt (1985). *Teaching the Fun of Physics*. New York: Prentice Hall.
- Vestley, Joan (1988). *Water and Ice*. Sunnyvale, CA: Creative.
- Villiams, Jack (1992). *The Weather Book: An Easy-to-Understand Guide to the USA's Weather*. New York: Vintage.
- Wood, Robert W. (1991). *Science for Kids: 39 Easy Meteorology Experiments*. Blue Summit, PA: TAB.



The Author:

Pat Bowers, Ph.D., is the Associate Director of the Center for Mathematics and Science Education at the University of North Carolina at Chapel Hill.

9

Habitat in a Book

by Laurie L. Presnell

Materials and Equipment:

- reference books
- pop-up books (if activity is to be done in pop-up form)

Q How do habitats differ?

Animal Research Data

- Describe the animal habitat. (desert, wetland, prairie/grassland, polar, city, etc.)
- What other animals and plants live in the same environment?
- What does the animal eat?
- What other animals in the same environment eat the same food?
- What do these other animals need to live? (trees, water, etc.)
- Where does the animal sleep?

Literature:

The Salamander Room by Anne Mazer

Focus:

Different plants and animals live in a variety of habitats. An animal's habitat includes all the plants and animals that live in it as well as the weather, soil and rocks. All animals need food, water. Animals need a place for protection and to raise their young. In this activity, students use research skills to learn about a selected animal and its habitat. They recreate and express their findings in book form.

Challenge:

What things are included in an animal's habitat?

If you were to change your room into a particular animal's habitat, what changes would you need to make?

Procedure:

1. Read *The Salamander Room* to the students. Discuss the way the author changes the boy's room into the habitat of a salamander. The author makes sure everything that might be in a salamander's environment is included in the making of the habitat.
2. Ask students to select an animal and research its habitat. Students will create that habitat as Mazer did. This can be done in a pop-up or regular book format.
3. Provide the students with a handout to assist them with their collection of animal research data.
4. Following the problem/solution pattern used in *The Salamander Room*, have the students complete a rough draft of each page of their books, edit the pages and finally publish their work. Illustrations in regular or pop-up format should be included.

Further Challenges:

- Share the books with younger students.
- Select endangered animals or animals from endangered habitats to create the books.

Resources/References:

Children's Books:

Clements, A. & Johnson, L. S. (1992). *Mother Earth's Counting Book*. Simon & Schuster.

Lester, A. (1990). *Imagine*. Houghton Mifflin.

Mazer, A. (1991). *The Salamander Room*. New York: Alfred A. Knopf, Inc.

Teachers' Books:

Irvine, J. (1987). *How to Make Pop-Ups*. New York: Morrow Junior Books.

Irvine, J. (1992). *How to Make Super Pop-Ups*. New York: Morrow Junior Books

The Author:

Laurie L. Presnell, Elementary
Teacher, Anchorage School District,
Anchorage, Alaska.



You're Bugging Me

by Jan Woerner

Materials and Equipment

- paper and pencils
- insect journals -- these should be done as circle books
- small hand magnifiers
- large standing table magnifier
- Live Animals
 - silkworm eggs
 - butterfly or moth eggs
 - crickets.
- Cages
 - caterpillar boxes
 - cricket homes
- Food for insects (see specific insect)

Literature:

Very Hungry Caterpillar by Eric Carle

Focus:

Children need many first hand experiences -- those which are directly observable by the senses, are concrete, and occur in real-life settings. First hand experiences with living organisms challenge students' observational abilities, and provide an opportunity for them to construct and organize their own knowledge of the many living things on Earth. Children's books containing pictures of insects provide second-hand experience, but may be used effectively to stimulate children's curiosity about the "real thing."

Although many people regard insects as obnoxious bugs or creepy crawlies, the huge number of different kinds of insects in all habitats makes them effective first hand examples of living things. Their comparatively brief life cycles provide the opportunity to directly observe entire generations and to see variety in the way animals carry on their life cycles.

There are a tremendous number of different kinds of insects, maybe even 10 or 15 million! They are part of the kingdom Animalia and in the class Arthropoda (animals with jointed legs and external skeletons). The insects are the most successful groups of similar animals on the planet, having more different kinds than all other kinds of animals put together. Among those insects that might seem common to us are flies, crickets, termites, aphids, beetles, fleas, butterflies, moths, and ants.

All insects change as they grow through a process called metamorphosis. Some insects hatch from eggs looking like smaller versions of the adult. These animals undergo simple metamorphosis, beginning as a nymph that molts and sheds its skin until it becomes an adult. The adults mate and produce eggs which begin the life cycle over again. An example of a common insect that does this is the cricket. Other insects undergo complete metamorphosis, beginning their lives as the egg hatches, and the larva begins eating and growing. A caterpillar is an example of a larva. As the larva grows, it sheds its skin several times until it reaches a stage in which it becomes quiet and produces a pupa. During the pupal or resting stage, the animal produces a chrysalis or cocoon. The adult emerges, mates, produces eggs, and dies.

Challenges:

What are the characteristics of insects?

What distinguishes an insect from other living things?

What do insects need in order to live and to grow?

How do insects change as they mature?

Are all insects alike?

Procedure:

1. The class could be divided in groups of four or eight, or one classroom set of insects might be observed. Children need to discuss acting responsibly toward the living organisms in your room, and you may need to develop guidelines for safe and appropriate behavior. Silkworms should not be handled very much, and a large magnifier on a wooden stand allows good observation without touching.

The observations will take place during free exploration and may occur over a month or more. Discussions of observations will take place as changes in the insects occur or when children have questions about the appearance of their insects.

2. Obtain the silkworm, and moth or butterfly eggs.

Silkworm eggs, painted lady butterfly eggs, and other insect eggs can be purchased from elementary science or biological supply companies, see appendix. Moth and butterfly eggs or caterpillars can be collected in the plants where they are laid and feeding. Butterfly or moth eggs that are produced one year can be kept in the refrigerator for the next class.

3. Caterpillar boxes can be made from a cardboard box.

Remove one of the sides of the box and cover it with clear plastic. Tape the plastic to the box so the caterpillars can't get out. Poke some holes in the cardboard for breathing and construct a doorway that can be opened to put fresh leaves in for the caterpillars each day. Caterpillars also can be kept in glass or plastic aquaria with fine netting, cheesecloth or screen covers. Most of biological supply companies also sell the "butterfly cages," although cages can be made from cardboard or wood and lightweight netting or cloth.

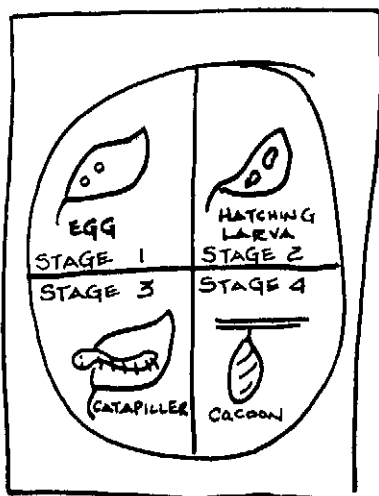
4. Chinese silkworms eat only mulberry leaves, but other giant silkworm varieties may eat other kinds of leaves also. They may eat their weight in leaves each day and need a fresh supply. Butterfly and moth larvae may prefer one specific type of plant or may eat several different ones. The Tiger Swallowtail prefers wild cherry, the cabbage butterfly eats cabbage leaves, the Monarch butterfly caterpillar eats milkweed, and the Sulfur eats clover. You can check some of the references for help with the food. Moist leaves will



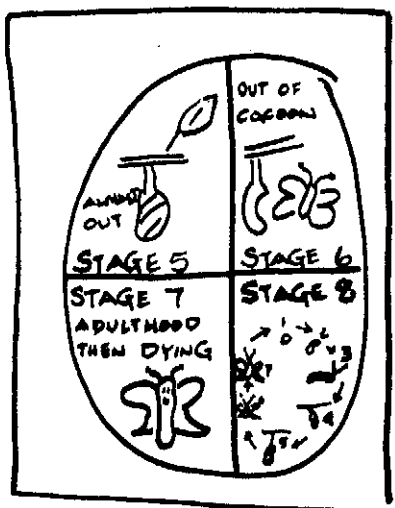
Plan to do the activities when there are no long holidays scheduled.



Q Are all eggs alike?



Q How are insects different from one another?



provide water. For most caterpillars you should not leave water dishes in the container.

5. Divide the eggs and leaves among several containers, or keep them as a class culture. Establish some guidelines for observing and give the students some time with magnifiers to see if they can see anything. Begin with a drawing in their journals and a short description of what they saw. Discuss the leaves and anything else they observe. Let them suggest what they believe the "eggs" to be in their own vocabulary. What do students think will happen to the "eggs"?

6. Observe the eggs during free time until larvae hatch. The students may have only one or two drawings at this time. Have the students discuss their observations.

7. A day or so after the butterfly or moth larvae have hatched, the teacher reads *The Very Hungry Caterpillar*. What does this caterpillar eat? What features or structures does this caterpillar have? Students are asked about their caterpillars and they are similar to or different from the one in the book. What do their caterpillars eat? What do students think will happen to the caterpillars? The students should make predictions and continue to watch their caterpillars. As changes occur, they should draw a new picture in their journal, showing the changes. Students do not need to draw each change in size of the caterpillar, but might do two or three drawings during this stage.

8. Students should observe the structures of the caterpillars closely with their magnifiers and try to draw accurate representations of what they see. Emphasize your guidelines on the care and safety of the animals. How do the caterpillars move? Where are the "legs" on the caterpillar? How many legs do they have? What does the caterpillar eat? How do the caterpillars behave with each other?

9. While students are observing the caterpillars grow, a class cricket colony can be obtained. Crickets can be found under leaves, branches, stones, and around the foundation of buildings. Crickets can be purchased from local bait shops, pet stores, or biological supply companies.

10. Cricket homes can be made in clear plastic basins or jars. They should include an area which is sandy, one which has food and water, and some dry twigs, leaves, stones, etc. If a "cricket cage" is purchased, make sure that the bars are less than 1/8 inch apart or tiny crickets will escape.

11. Crickets eat many things, including cotton fiber. As a regular diet, however, small pieces of lettuce, soft fruit such as a banana, a tiny piece of cheese, some bits of dog biscuit, pieces

of vegetables, and bread are good. They can get enough water from the food provided fresh daily, but you might provide a small tube of water with a cotton plug in its top. Place the tube on its side. Change every few days.

12. Introduce *The Very Quiet Cricket* a few days after the cricket colony is put in the classroom. Other books on insects may be placed in a center and read to the class when questions about other insects arise naturally from the children.

13. Students should observe the crickets, looking for differences and similarities between the crickets and the caterpillars. Crickets can be observed for many weeks also. New cricket journals showing cricket structures and changes should be started. The same questions asked about caterpillars should be asked about the crickets. What do baby crickets look like? Where are their legs? How many legs to they have? What happens as they grow? What features can you see on a cricket's head? Does it look like the head of the caterpillar?

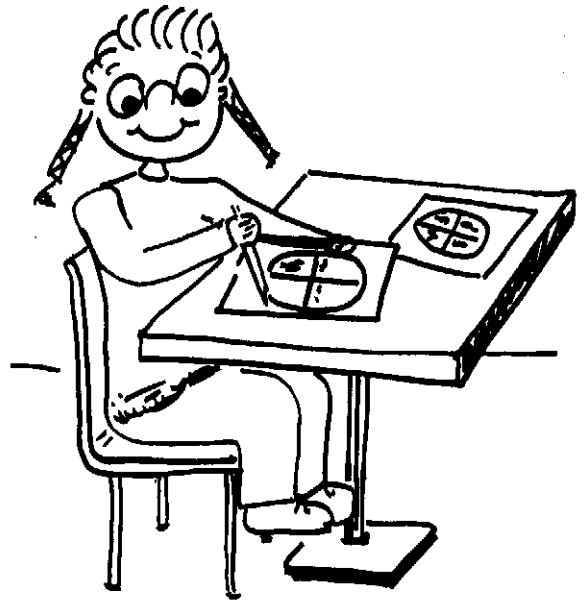
14. Continue comparison of the two types of insects as they grow and change. Students can try to find out if crickets like dark or light better. They could try to see what food crickets like best, or what their favorite color might be by placing colored plastic jars inside the cage with the favorite cricket food in each jar.

15. When the insects undergo changes, have the class (or the small groups) report what they have observed. Compare the observations, helping students to recognize life cycle changes, stages, and structures. Students should decide what the insects need to live and grow, and they should be able to describe the insect and its life cycle stages. These ideas will take time to develop. These activities could continue all year, but the caterpillars will change in about a month. Once mating has occurred and the eggs are laid, the butterflies or moths will die. The structures of the adults should be observed, and the eggs can be stored in the refrigerator.

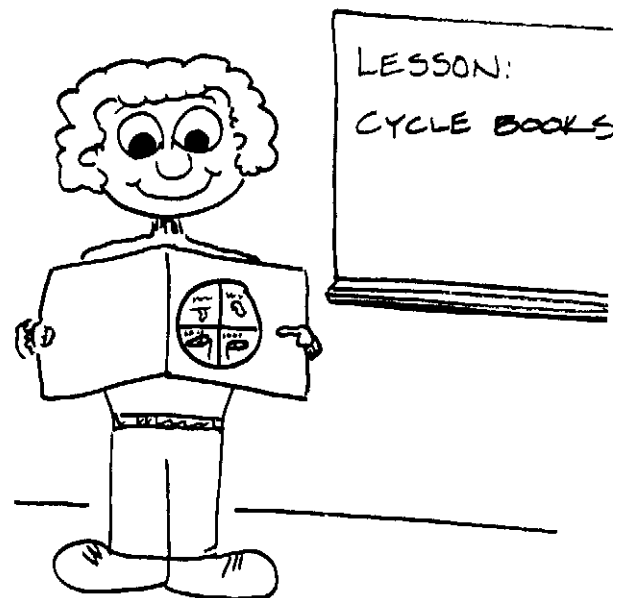
Assessments:

- A rubric can be developed to evaluate the students' journals, looking for descriptions of structures and life cycles. Students could use their journals to explain to another class of students about their observations, or could explain to siblings at home about the project. The class could create a poster about the life cycles for display in the hall, lunchroom, or office. Life cycle "puzzles" can be created so students can put stages of insects in order.

Q How do crickets make sounds?



Q Do trees have a cycle?





- A good evaluation at the end of many observations of insects is to provide students with real animals, remains of dead insects from the class collection, plastic models of animals, or pictures of animals and ask, "Is this an insect?" "How do you know?" Both examples and non-examples need to be included. This activity can be done as a whole class. The teacher can hand a plastic fly to a student who replies whether it is an insect and one property that lead the student to that conclusion. Plastic models of all kinds of animals are available at department stores, nature stores, zoos, museums, etc.

Further Challenges:

- Obtain and maintain an ant farm. Observe these insects and compare them to the butterfly and cricket. Students can be encouraged to find out what food ants or crickets prefer.
- Mealworms can be obtained from bait and pet stores, and a class culture of mealworms can also be studied.
- Some of the additional insects mentioned in *The Very Quiet Cricket* could be obtained and observed. If real life insects are not available, plastic models or pictures could be used. *The Icky Bug Alphabet Book* also has many other insects illustrated.

Resources/References:

Children's Books:

- Carle, E. (1969, 1987). *The Very Hungry Caterpillar*. New York: Philomel Books, a division of The Putnam and Grosset Group.
- Carle, E. (1990). *The Very Quiet Cricket*. New York: Philomel Books, a division of The Putnam and Grosset Group.
- Carle, E. (1977). *The Grouchy Ladybug*. New York: Thomas Y. Crowell.
- Conklin, G. (1966). *The Bug Club Book*. New York: Holiday House.
- Conklin, G. (1969). *When Insects are Babies*. New York: Holiday House.
- Goudey, A. E. (1964). *Butterfly Time*. New York: Charles Scribner's Sons.
- Hogner, D. C. (1960). *Grasshoppers and Crickets*. New York: Thomas Y. Crowell Company.
- Mitchell, R. T. & Zim, H.S. *Golden Nature Guide to Butterflies and Moths*.
- Pallota, J. (1986). *The Icky Bug Alphabet Book*. Waterstown, MA: Charlesbridge Publishing Company.

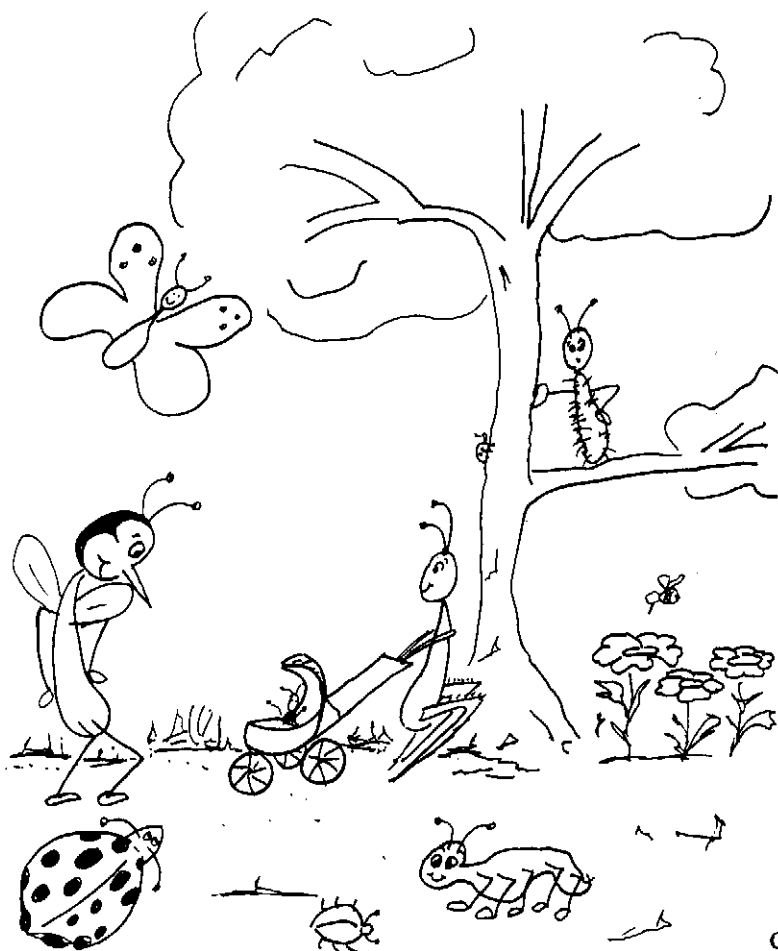
- Philpot, L. & Philpot, G. (1994). *Amazing Anthony Ant*. New York: Random House.
- Simon, H. (1962). *Exploring the World of Social Insects*. Toronto, Canada: The Copp Clark Publishing Company.
- Simon, S. (1973). *Discovering What Crickets Do*. New York: McGraw Hill Book Company.
- Teale, E. W. (1972). *The Junior Book of Insects*. Toronto, Canada: Clarke, Irwin & Company, Ltd.
- Thomson, R. (1990). *Creepy Crawlies*. New York: Aladdin Books, Macmillan Publishing Company.
- Van Allsburg, C. (1988). *Two Bad Ants*. Boston: Houghton Mifflin.
- Whalley, P. (1988). *Butterflies and Moths*. New York: An Eyewitness Book from Alfred A. Knopf.
- Zim, Herbert S. and Cottam, C. (1951). *Insects. Golden Nature Guide*. New York: Golden Press and Racine, WI: Western Publishing Company, Inc.
- Zoobooks, Volume 7, number 9 (1990). *Butterflies*. San Diego, CA: Wildlife Educational, Ltd.

Teachers' Books:

- FOSS (Full Option Science System) Module for grades 1-2, Lawrence Hall of Science (1993). *Insects*. Chicago: Encyclopaedia Britannica.

The Author:

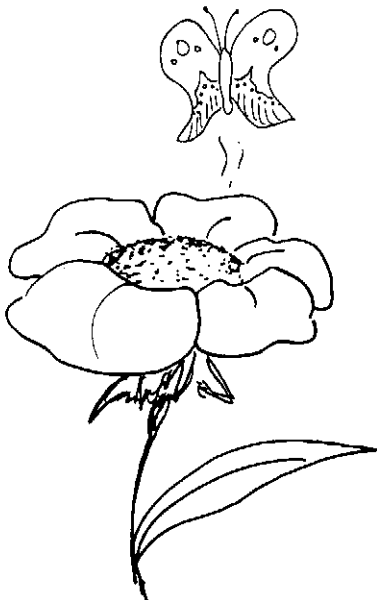
Jan Woerner, Associate Professor of Education, Elementary and Bilingual Education Department, California State University, San Bernardino.



Materials and Equipment:

- posters or books with butterfly pictures
- coffee filter butterfly (for a pattern see Critters in References)
- water in a wide mouth clear plastic cup or butter tub
- paper towels
- black construction paper strips for legs and antennae
- water soluble brown and black markers
- scissors

Q How does a butterfly change?



Literature:

I Wish I Were A Butterfly by James Howe, Illustrated by Ed Young

Focus:

Paper chromatography is used to demonstrate that colors are mixed and part of the black and brown inks. When using water soluble markers these colors are easily separated into various rainbows of color. Each brand of marker will have its own mixture.

Challenge:

Why does the drab brown and black butterfly change into a colorful butterfly?

Procedure:

1. Read the story orally. A little cricket wants to be a beautiful butterfly. He can see nothing good about his drab looks or existence and other creatures he meets reinforce this, until he meets the Old One. The Old One is a wise spider who helps the little cricket find his own beauty as he begins to make music for her as she spins a new web. The story is open-ended and allows the opportunity for discussing, writing, illustrating, and several science experiments.
2. Discuss the beauty within everyone; each has a special talent. Discuss how caterpillars change into butterflies. What form was the little cricket before we met him? Does he ever change into another form?
3. Provide students with a coffee filter butterfly. Have them make dot designs on the butterfly using brown and black markers. Stress the importance of not putting marker on the body, only on the wings. Point out the symmetry of the wing patterns and encourage students to make their patterns symmetrical. If a variety of markers are available, have each student record the color and brand of marker. Have a sample to show them it is necessary to have white space for the colors to appear.
4. In wide mouth cups or margarine tubs, add a small amount of water, one centimeter deep or less. It should be below the level of the marker.

5. Place the butterfly in the container. Rest the body in the water, but keep the wings resting on the sides. The color separation can take five to ten minutes. Older students can record observations, younger students can contribute to a group chart of observations.

6. When completed remove the butterflies and place them on paper towels to dry. Students can write their names on the paper towels.

7. When dry, have students add the legs and antennae.

8. Write a story about how it feels to be a beautiful multicolored butterfly.

9. Compare patterns and colors, can students find some other butterfly design from the same markers? Have several mystery butterflies available for students to compare, analyze, and identify the brand of markers used.

Further Challenges:

- Students can try different brands of markers, different solvents, different types of filter paper, and different amounts of time. If older children are doing the activity permanent markers may be included. Although not water soluble, most are soluble in alcohol.
- If crickets are available, from home or a pet store, they provide a fascinating source of investigation. Some easy topics to observe: What foods do they prefer? Do they prefer light or dark? moist or dry? warm or cool? What part of their body is used to "sing"? Is there a relationship between the number of chirps and the temperature? Can you determine which are male and female? Can you identify the variety found in your area?

Resources/References:

Children's Books:

Howe, J. *I Wish I Were a Butterfly*.

Kent, J. (1982). *The Caterpillar and the Polliwog*. Simon & Schuster

Ryder, J. (1989) *Where Butterflies Grow*. Lodestar.

Turner, G. (1989). *Colors*. Viking Kestrel.

Teachers' Books:

Critters: Activities Integrating Mathematics and Science.

(1989), AIMS Education Foundation, Fresno, CA: AIMS

Crime Lab Chemistry: Great Explorations in Math and Science (GEMS). University of California, Berkeley:

Lawrence Hall of Science

Q How can we help this butterfly turn into a colorful one?

Q Do all brands of one color of a marker separate the same? Are some colors more interesting than others when they separate?



The Author:

Carol Van De Walle, AlWood Elementary School, Alpha, Illinois.

12

Colors, Colors And Even More Colors

by Audrey H. Brainard and Denise H. Wrubel

Materials:

- food coloring
- white canned frosting
- graham crackers
- craft sticks, one for each child and some extras
- feathers
- a 60-90 watt incandescent light bulb socket and cord for light bulb

Literature:

Thinking About Colors, by Jessica Jenkins

Focus:

When the primary pigment colors; red, blue, and yellow are mixed together many different colors are produced. Light is made up of many colors and can be separated into the colored light called the spectrum.

Challenges:

How are new colors produced?

Are all "greens" alike?

Who names colors?

How can white light be separated?

Activity 1

Procedure:

1. Read *Thinking About Colors*. Discuss the many shades of each color found in the top border. Ask, "How were the colors created?"

2. Let the children make up red, blue and yellow frosting. Add food coloring to frosting. Is the color the same throughout? Continue to add drops of food coloring to produce the desired shade. *The red will never be a pure red.* Use craft sticks for stirring, being careful that colors are not mixed.

3. Provide containers of the primary colors of frosting plus white. Leave a craft stick in each container.

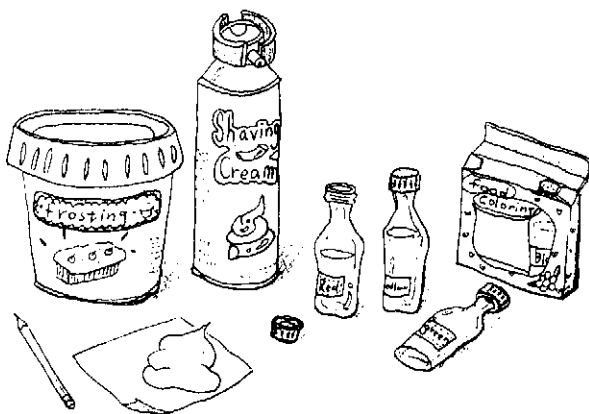
4. Give each child their own craft stick. Explain they are to use it with their frosting on their cracker only. To keep their colors pure they may lick it off between using it in new colors.

5. Use a graham cracker as a palette. Put a dab of two or more colored frosting on the cracker. Mix a small amount of two colors. Ask, "What color have you produced?" "Can you give it a name? Children will need to add to their dabs of frosting throughout the activity.

6. How are orange, purple and green produced? What other colors can you create?

7. Can you make the exact color or shade again?

Q What does yellow make you think of?



Q How is lavender made?

8. Ask them to gently mix all the colors. Does it look good to eat? Does color affect what we eat? Have you ever eaten blue mashed potatoes or a purple cake? Tell the children that they may eat their cracker.

Activity 2

Procedure:

1. Close one eye. Hold a feather in front of the open eye. Look through the feather at an incandescent light bulb. What do you see? The children should be able to see the spectrum or a "rainbow."

2. Where else do you see colors like you see through the feather?

3. The next time a rainbow appears take time to observe it and discuss its colors and shape.

Further Challenges:

Colored Drops

Fill a gallon jar with water and place the jar where the children can observe it from all sides. Leave the jar overnight so that the water can settle. From a height of 6 cm drop one drop of red, yellow, and blue food coloring in the jar. Have the children describe what they see.

Ask them to draw a picture showing what they saw?

Use a jar of freshly filled water and compare the color pattern.

Looking For Colors

Go for a walk and look for the color green. Are all leaves on a tree the same shade? How many different shades of green were found? Find another common color found in the environment and see how the shades and intensity vary.

Changing Color

Over a period of time observe and discuss color changes in; leaves turning, cooking an egg, making toast, rotting fruit or vegetables, molding bread, snow getting dirty, sky colors.

Adopt a tree and spend time with it at least once a month.

Observe its change in color.

Color A Day

Wear clothes of the color. Act like the color. Eat food of the color.

Use paper, pen, pencil, chalk, napkins, of the color.

Set up a display of items of the color.

Allow children to discuss how the color makes them feel.

Focus on a poem about color

Q Who eats blue potatoes?

Q How does a prism work?



Q How are different shades of green created?

Q What do hailstones and halibut bones have in common?

Read a poem from *Hailstones And Halibut Bones*. Display items that are mentioned in the poem. After reading the poem compare and contrast the items. How could the items be grouped or classified?

Write a class poem about color.

Resources/References:

Children's Books

Carle, Eric.(1975, 1984) *The Mixed Up Chameleon*. New York. Harper Collins.

Craft, Ruth.(1988) *The Day Of The Rainbow*. New York. Puffin Books.

Ehlert, Lois.(1988) *Planting A Rainbow*. New York. Harcourt Brace

Jenkins, Jessica.(1992) *Thinking About Colors*. New York. Dutton.

McMillan, Bruce.(1988) *Growing Colors*. New York. Lothrop, Lee & Shepard.

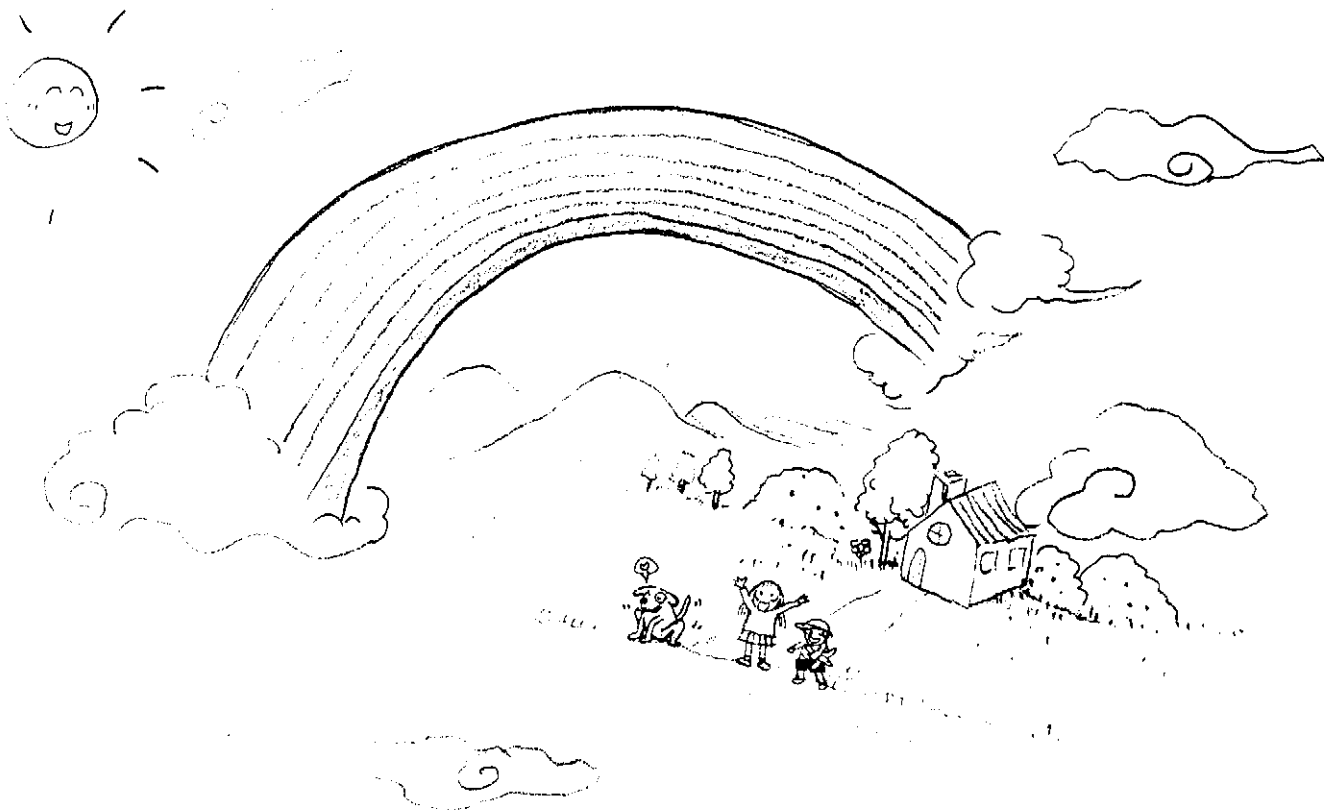
O'Neill, Mary.(1961, 1989) *Hailstones And Halibut Bones*. New York. Doubleday.

Stinson, Kathy. *Red Is Best*.

The Authors:

Audrey H. Brainard, Elementary Science Consultant, Hands-On Science Associates, Heathsville, VA

Denise H. Wrubel, Science Teacher, Holmdel, NJ and Elementary Science Consultant, Hands-On Science Associates



Exploring the Third Dimension

13

by Donna Gail Shaw and Claudia S. Dybdahl

Literature:

Sam, Bangs and Moonshine by Evaline Ness

Focus:

This exploration of characterization is intended to integrate the science and language arts curricula, specifically to allow an integrated study of the third dimension. In this activity students will have the opportunity to discover how 3-D glasses work as well as how writers develop depth in their characters.

Challenges:

Can you construct a pair of glasses that allows you to see in 3-D?

What does an in-depth character mean in literature?

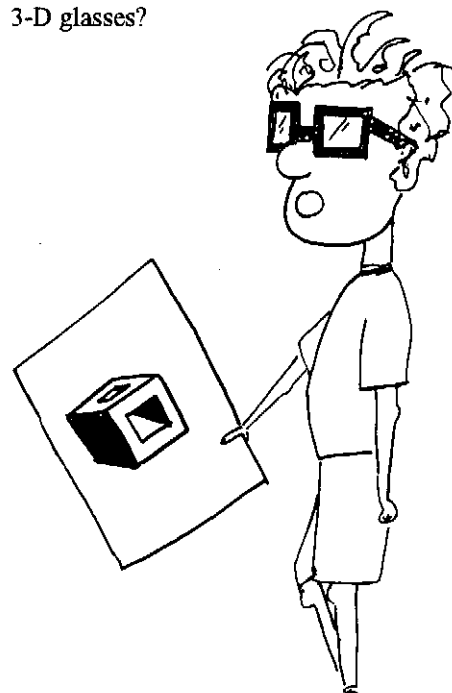
Procedure:

1. Obtain or make 3-D glasses. To make 3-D glasses see the directions at the end of this article.
2. Draw a red line on white paper. Right next to it draw a blue line.
3. View the lines through your 3-D glasses.
4. Try drawing different shapes and objects using red and blue lines side by side.
5. When a red/blue drawing is viewed with 3-D glasses the drawing should appear to vibrate and you should see an illusion of depth. The vibrating effect is caused by the fact that one of your eyes is seeing a red image and the other is seeing a blue image. The brain attempts to put the two images together but it cannot. Instead you see red for an instant, blue for an instant, red for an instant and so on. The jumping back and forth creates the same muscular sensations that cause you to see depth.
6. The D in 3-D stands for dimension. Let's pretend to take a walk in the three dimensions. If you walk in a straight line, you are taking a one-dimensional walk (straight line journey between two points). If you decide to zig-zag or turn on your walk, you are taking a two dimensional walk (flat surface). If you decide to go up a flight of stairs on your walk you are taking a three-dimensional walk (up and down as well as side to side).

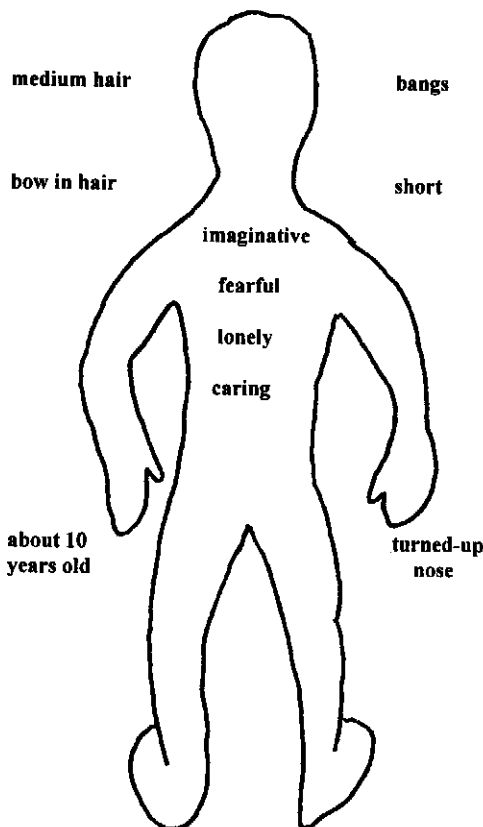
Materials and Equipment:

- 3-D Glasses
- white paper
- blue pencil
- red pencil
- colored acetate (red & blue)
- overhead of character map
- student copies of character map

Q What do you see when you look through 3-D glasses?



Q How else might you experience 3-D motion?



In the 1950s 3-D horror movies were very popular. These movies work by giving you two slightly different images and your brain combines them into one image that has depth. Two cameras are used in the filming of the movie; one takes in light from the right-eye viewing angle and the other from the left. Two projectors are used to show the film. Each projector has a filter that orients the light waves; one vertically and one horizontally. The two lined up images bounce off the screen toward the viewer. The 3-D glasses (also filters) make sure the right eye receives only the right-eye view and the left eye receives the left-eye view. The brain combines the two images to create one with depth.

Today 3-D images have uses in science, industry and medicine. Holograms are 3-D images and are frequently found on credit cards.

7. Explain to the students that just as drawings and movies may have depth so may characters in books. When we say that a character has depth, we mean that we know something about the "inside" of that person. Things that may be on the inside of a character are feelings, beliefs and attitudes. Discuss with the students the difference between physical (outside) characteristics and psychological (inside) characteristics that are not as readily observed.

8. Make a master of a simple character map such as the one shown and project it on the overhead. Then read *Sam, Bangs and Moonshine* to the class. Following the reading discuss the physical and psychological features of Sam and record appropriate responses on the overhead.

9. Distribute a character map to the students. Invite them to select a character from a book they have read or are reading and to complete the map. Additional titles for literature exemplifying character development can be found in the reference section.

Further Challenges:

- Can you explain the process that enables you to see the third dimension?
- Can you find out how 3-D images are used in science, industry or medicine?
- Why are holograms put on credit cards?
- What techniques do writers use to help you "see" inside a character?

Resources/References:

Children's Books:

Cleary, B. (1968). *Ramona the Pest*. New York, NY: Scholastic Book Services.

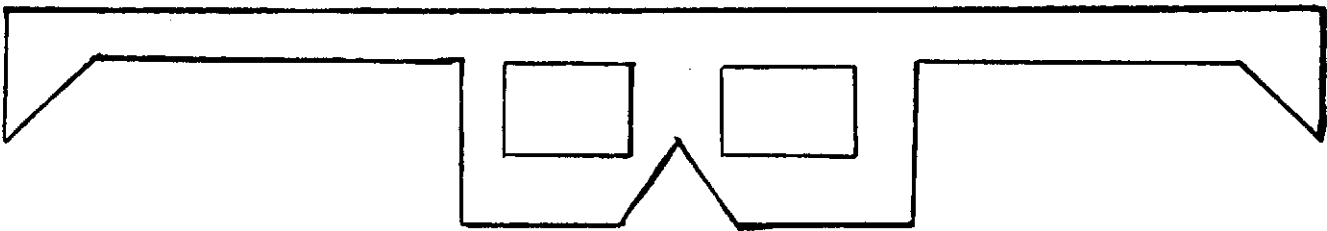
- dePaola, T. (1978). *The Clown of God*. New York, NY: Harcourt, Brace Jovanovich.
- George, J. C. (1972). *Julie of the Wolves*. New York, NY: Harper & Row.
- Miles, M. (1971). *Annie and the Old One*. Boston, Mass. Atlantic Monthly Press Book.
- Ness, E. (1966). *Sam, Bangs and Moonshine*. New York, NY: Holt, Rinehart and Winston.
- Patterson, K. (1977). *Bridge to Terabithia*. New York, NY: Harper & Row.
- Peck, R. N. (1983). *Soup in the Saddle*. New York, NY: Alfred A. Knopf.
- Van Allsburg, C. (1979). *The Garden of Abdul Gasazi*. Boston Mass.: Houghton Mifflin.

The Authors:

Donna Gail Shaw and Claudia S. Dybdahl,
Associate Professors, University of Alaska
Anchorage, Anchorage, Alaska.

To make 3-D glasses do the following:

- Cut a 14" by 2 1/2" rectangle from lightweight cardboard (back of legal size paper pad works well).
- Enlarge the pattern below.
- Trace it onto the cardboard and cut it out.
- Tape a red acetate in one eye hole and a blue acetate in the other.



14

In the Cover of Darkness: Night Themes

by Claudia Dybdahl and Donna Gail Shaw

Materials and Equipment:

- various single-colored objects
- two or more titles from each of the literature categories listed in the references
- large piece of butcher paper taped horizontally to the wall (5-6 feet long)
- black felt marker

Literature:

Dawn by Uri Shulevitz

Focus:

This exploration of literature dealing with the "night" is intended to integrate the science and language arts curricula, specifically to allow an integrated study of how the eye sees color. In this activity students will have the opportunity to discover the scientific reason why colors are not seen at night and how writers of fiction use the cover of darkness to create imaginative and compelling tales.

The inner layer of the eyeball is known as the retina. Within the retina are two types of light-sensitive cells known as rods and cones. The cones, which are sensitive to moderate to bright light, help us see during daylight hours or in lighted areas and are responsible for color vision. The rods, which are sensitive to low light, help us see at night or in dark areas and do not respond to color. This explains why objects appear to lose their color at dusk or in dimly lit areas.

The cones are clustered mainly in the central region of the retina while the rods are more evenly spread across the retina. As a result of this arrangement, it is possible to demonstrate that rods do not see color even while in a well-lit room.

Challenges:

Why do we not see color when it is dark?

Why does our imagination "run wild" at nighttime?

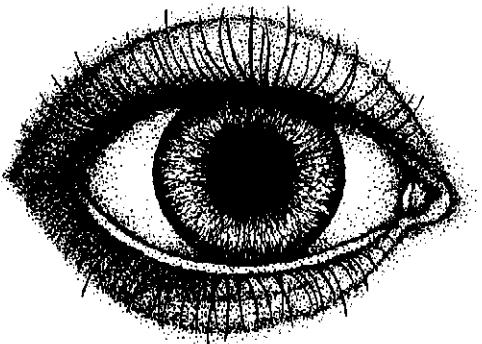
Are there categories or types of night stories that can be discovered?

Procedure:

This activity is easily done with the whole group and is intended to continue throughout the week after being introduced on Monday.

1. Have one student sit facing a blank wall or chalkboard. The student should stare straight ahead at the wall and not move the eyes from side to side.

- Take an object that has one distinct color (red book, green apple, etc.). Slowly move this object into the peripheral vision of the student from behind.
- The student should tell you when s/he first sees the object.



- Quickly remove the object and ask the student what color it was.
- May repeat steps above using different students and different objects.
- If the directions were followed, the student should not be able to tell the color of the object because the rods were mainly used to see the object rather than the cones.

2. Write the word "imagination" on the board and ask the class for words that they associate with this target word. Write the students' associations on the board.

3. Explain to the class that when they watch a movie or TV show, they are passive observers and do not have to use their imaginations to determine what is happening. However, ask them if they have ever noticed when they read a book that they usually visualize the action taking place. Their imaginations are activated because there is less stimulation from the environment, i.e. no exciting sound or picture, as with TV.

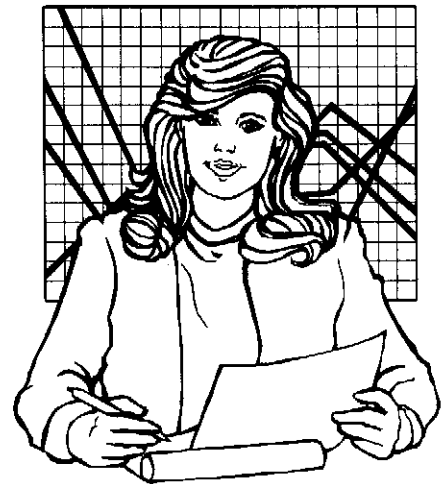
4. Ask the students what happens to their imaginations at night. Explain to the students that since the rods respond in dimly lit areas resulting in little or no color vision, their imaginations may be activated because less stimulation is coming from the environment, i.e. little or no color.

5. Many authors have taken advantage of the imagination stimulated in the cover of darkness. Tell the class that during the week you will be sharing some books with them that are written about the night. They are all alike in that they are very imaginative, but they are different in that they present different experiences that may happen at night. Explain that some of the views of the night that you are going to share include: dreams, journeys, fears and shadows, noises and fantastic creatures. Invite the class to discuss each category and predict what a book in that category might be about. Write each category name on the butcher paper (at the top, as a column heading).

With a partner have the students further tell each other about their night experiences with any of the categories, either book experiences or personal experiences.

6. The teacher then reads two of the books to the class. After each book the class decides to which category the title best belongs. (In some cases more than one category may seem appropriate. As long as the students present reasonable alternatives, it doesn't matter. Such disputes are best resolved by a class vote.) The title of the book is then written with the black felt marker under the appropriate category name.

Q Can you describe what your favorite radio commentator looks like?



Q How do colors change in the early morning?

Q How do your eyes compare to your pet's eyes?



7. The teacher invites the class to browse through the books during the week. Each day two or three books are read aloud, discussed, and categorized.

8. At the end of the week students review the themes and the titles that are entered under each category name. Then, they are invited to write their night theme story. For those students that have a harder time getting started, discuss with them which category of story they have selected and review with them what happens in that type of story. If final drafts and publication are desired, then the writing will continue into the next week.

9. After all the students' stories have been finalized and in some way shared read Uri Shulevitz's book called *Dawn*. This book beautifully portrays the emerging light of the new day and the colors that appear with the light.

Further Challenges:

- Ask students to find additional books in the library dealing with night themes and share them with the class.
- Ask students to read aloud to the class a favorite night scene from any book of your choice?
- Some animals are nocturnal. Find such an animal and do a research project focusing on the special behaviors of your chosen animal. Make a cube of facts or a fact mobile to share with the class.

Resources/References:

Shulevitz, U. (1974). *Dawn*. New York, NY: Farrar, Straus & Giroux.

Dreams

Brown, M.W. (1990). *The Dream Book*. New York, NY: Columbiana, Alabama: Hopscotch Books.

Goble, P. (1990). *Dream Wolf*. New York, NY: Bradbury Press.

James, B. (1990). *The Dream Stair*. New York, NY: Harper & Row.

Nunes, S. (1988). *Coyote Dreams*. New York, NY: Athenum.

Sendak, M. (1970). *In the Night Kitchen*. New York, NY: Harper & Row.

Skofield, J. (1981). *Nightdances*. New York, NY: Harper & Row.

Journeys

Gregory, V. (1992). *Through the Mickle Woods*. Boston, Mass.: Little, Brown and Company.

Heine, H. (1989). *The Marvelous Journey Through the Night*. New York, NY: Farrar, Straus & Groux.

- Morgan, N. (1990). *Louis and the Night Sky*. New York, NY: Oxford University Press.
- Rosenberg, L. (1989). *Adelaide and the Night Train*. New York, NY: Harper & Row.
- Ryder, J. (1985). *Night flight*. New York, New York: Macmillan Publishing.
- Van Allsburg, C. (1982). *Ben's Dream*. Boston, Mass.: Houghton Mifflin.

Fears and Shadows

- Alpert, L. (1991). *Dancing with the Shadows in my Room*. New York, NY: Whispering Coyote Press.
- Brown, M. (1982). *Shadow*. Charles Scribner's Sons.
- Irving, W. (1989). *The Legend of Sleepy Hollow*. (Adapted and Illustrated by Robert Van Nutt). Westport, Conn: Rabbit Ears Books.
- Mayer, M. (1968). *There's a Nightmare in my Closet*. New York, NY: Dial Press.
- Reeves, M. R. (1989). *The Spooky Eerie Night Noise*. New York, NY: Bradbury Press.
- Stolz, M. (1988). *Storm in the Night*. New York, NY: Harper & Row.

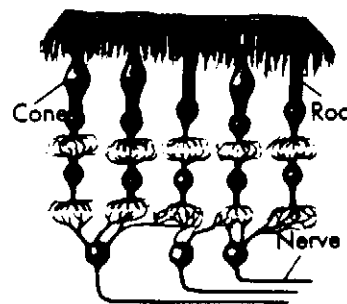
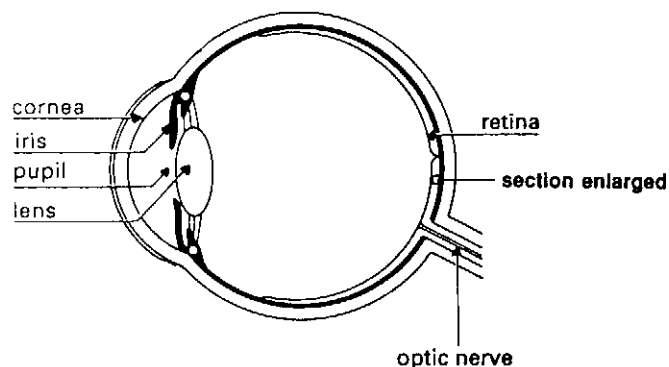
Night Noises

- Aylesworth, J. (1991). *Country Crossing*. New York, NY: Atheneum.
- Fox, M. (1986). *Night Noises*. New York, NY: Gulliver Books.
- Rylant, C. (1991). *Night in the Country*. New York, NY: Aladdin Books.
- Yolen, J. (1987). *Owl Moon*. New York, NY: Philomel Books.

Fantastic Creatures

- Carter, D. (1991). *In a Dark, Dark Wood*. New York, NY: Simon & Schuster.
- Ryan, C. D. (1971). *Hildid's Night*. New York, NY: Macmillan Publishing.
- Waddell, M. (1989). *The Park in the Dark*. New York, NY: Lothrop, Lee & Shepard Books.
- Wiesner, D. (1991). *Tuesday*. New York, NY: Clarion Books.

Parts of Eye



Enlarged Section

The Authors:

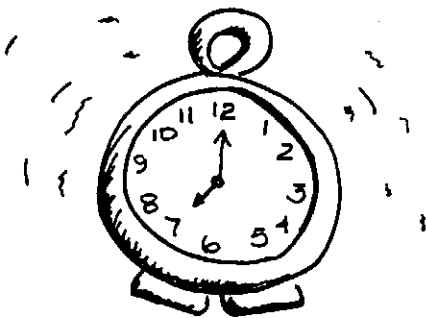
Claudia Dybdahl and Donna Gail Shaw,
Associate Professors, University of Alaska
Anchorage, Anchorage, Alaska.

Surrounded by Sound

by Edward L. Shaw, Jr. and Robert L. Doan

Materials and Equipment:

- blindfold
- prepared tape cassette
- tape player



Q Are some children's voices more easily recognized than others?

Q Do all crickets sound the same?

Literature:

The Very Quiet Cricket by Eric Carle

Focus:

Developing the concept of relating sounds and their origins. Explain that sounds can be classified by their source, not where they are heard.

Challenges:

What sounds are heard around the house?

Do these sounds come from outside or in the house?

How do we know if sounds are "household" or "outdoor" sounds?

Procedure:

1. On a cassette, record sounds of the household and outdoors.

Suggested sounds:

- **Household sounds:** ticking clock, running water, setting the table, vacuum cleaner, TV news program, door bell, telephone ring.
- **Outdoor sounds:** train, auto traffic sounds, car horn, garbage cans clanging, construction sounds (hammering, electric saws), rain, thunder, wind

Record the sounds randomly, mixing household and outdoor sounds.

2. Organize the children in a circle, sitting on the floor. Tell the children you are going to blindfold one of them; then point to several students, one at a time. Each designated child will say, "Who am I?" The blindfolded child will try to guess the child's identity. Develop the concept that voices are not all the same, just as other sounds are not the same. For example, a car horn sounds different from a barking dog.

3. Read the book *The Very Quiet Cricket*. Discuss with children the various kinds of sounds. Then focus the discussion on just two kinds of sounds: household and outdoor sounds. Provide examples. Say, "When you hear a car horn, is that a sound coming from the house or outdoors? When you hear an alarm clock, is the sound coming from outdoors or the house?" When the concept of household and outdoor sounds has been established, prepare to play the recorded sounds. Tell the children you are going to play a sound and they will tell you if it is a household or an outdoor sound. (You should decide how you want the children to respond; hold up hands, speak out, take turns, etc.) Next, start

the tape, play one sound, stop the tape for children's response and then play the next sound. Repeat this procedure through all the household and outdoor sounds.

4. When all the sounds have been identified, select one or two household sounds from the tape, play them, and solicit from the children where those sounds come from in their homes.

Assessments:

- The purpose of this assessment is to determine if children understand that household and outdoor sounds are determined by where the sound originates-not where it is heard.
- Ask the children, "If you are sitting at home watching TV and you hear the neighbor's car horn honking, is it a household or outdoor sound?" Then, "If you are playing in your yard and you hear your phone ringing, is it a household or outdoor sound?"
- Discuss again how a sound is classified according to its origination.

Further Challenge:

- What are some sounds that could be either household or outdoor sounds? They could be: barking dog, phone ringing (car phone), birds singing (canary, etc.), radio, people talking.

Resources/References:

Children's Books:

Britannica Discovery Library (1974). *The Sounds Book*.

USA: Encyclopedia Britannica, Inc.

Carle, E. (1990). *The Very Quiet Cricket*. New York: Philomel Books.

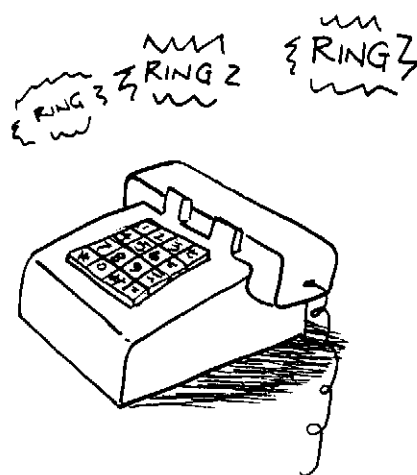
Seuss, Dr. (1970). *Mr. Brown Can Moo! Can You?* New York: Random House, Inc.

Tresselt, A. (1990). *Wake Up, City!* Lothrop, Lee & Shepard Books

Webb, A. (1988). *Talk About Sounds*. New York: Franklin Watts Inc.

Teachers' Books:

Broekel, R. (1983). *Sound Experiments*. Chicago: Children's Press.



The Authors:

Edward L. Shaw, Jr., Ed.D., is an Associate Professor at the University of South Alabama.

Robert L. Doan, Ed.D., is a Professor at the University of South Alabama.

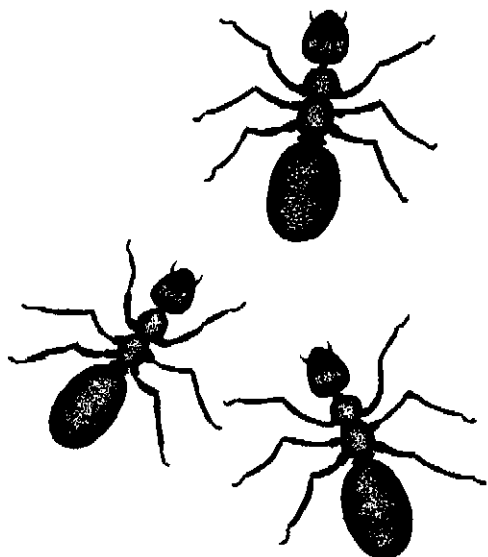
16

Appearing in the Drink

by Michael J. Strauss

Materials and Equipment:

- various kinds of crystals:
- table salt,
- kosher or pickling salt,
- rock salt,
- sugar
- mineral crystals
- magnifying lens or pocket microscope
- clear glass plates
- liquid measuring device



Q How many items can you name that are crystals?

Literature:

Two Bad Ants by Chris Van Allsburg

Focus:

Crystallization is just the opposite of dissolving. It occurs when the bits of solid in a solution come together and stack themselves into a crystal. The dissolved solid seems to appear out of nowhere. It comes from the dissolved bits of solid in the solution when we cool the solution or when we allow some of the water in the solution to evaporate.

Challenges:

What are crystals?

How do crystals form?

Activity 1: Getting Started

Procedure:

1. Read *Two Bad Ants*.
2. Ask the children to imagine what is happening in the story. Stop periodically to discuss what they think is occurring.
3. Ask the children to identify the crystals the ants stole.
4. Begin exploration of crystals by collecting various kinds of mineral crystals. These are easily obtained at rock shops or rock and mineral shows. Try to get crystals of different shapes and colors. Have the children each take one, draw a picture of it and write a description.
5. Ask them where they have seen crystals in the natural world. Many of them will have seen quartz crystals before and some may even have rock collections with crystalline minerals. Other examples you might mention would be snowflakes, frost, and ice freezing on the surface of a pond. Crystals from the grocery store include different kinds of salt, sugar, rock salt, and rock candy.
6. Have samples of salt and sugar for them to examine under a magnifying glass or with a pocket microscope. Have them try to describe the differences between these crystals by writing and drawing.

Adapted from a chapter in the book *WHERE PUDDLES GO - Exploring Physical Change* by Michael J. Strauss, to be published in August 1995, by Heinemann, Portsmouth, New Hampshire.

Activity 2: Experimenting with Crystallization

Procedure:

1. Dissolve as much kosher salt as you can in 50 ml of very hot water. Kosher salt will produce a clear solution that will produce better crystals. Use a medicine dropper to place some of the solution on two clear glass plates. Put one plate in the refrigerator and leave the other in your room. Keep an record of what happens in a science notebook.
2. Repeat the experiment with sugar.

Further Challenges:

- Start a crystal collection. You can begin with crystals you make from salt. You can get more at a nature store, hobby shop or a rock and mineral shop. You might also get a crystal growing kit at the hobby shop or nature store.
- Draw a picture of a crystalline mineral or piece of quartz crystal. Explain how you think such a crystal might form.
- Baking soda dissolves in water. What would happen if you dissolved a lot of it in hot water, poured the solution on a large flat plate, and waited a week?
- Fill clear glass soup or cereal bowls with clear regular soda and clear diet soda. Put them on a shelf where dust cannot fall into them and keep a record of what happens over time. Be very patient. This experiment may take several weeks.
- Find a cook book which has directions for making rock candy. Follow the directions. How are the crystals different from those obtained in the experiment you did with sugar on the plate above?
- How are crystals of salt and sugar different? How are they the same? Write a description of how a crystal of salt can form in a solution of saltwater. Draw pictures to go with your description.

Q How are salt and sugar crystals the same? How are they different?



Resources/References:

Children's Books:

- Dorros, A. (1987). *Ant Cities*. Scholastic, Inc.
Pinczes, E. (1993). *One Hundred Hungry Ants*. Houghton Mifflin, Co.
Van Allsburg, C. (1988). *Two Bad Ants*. Houghton Mifflin.

Teachers' Books:

- Van Cleave, J. (1989). *Chemistry Experiments for Every Kid*. New York: John Wiley & Sons.
Wood, R. W. *Science For Kids: 39 Easy Experiments*. Blue Ridge Summit, Pennsylvania: TAB Books.

The Author:

Michael J. Strauss, Professor of Chemistry, The University of Vermont.

17

Slime Goes to School

by Pamela O. Fleege, Ph.D. and Betty Crocker, Ph.D.

Literature:

Bartholomew and the Oobleck by Dr. Seuss

Focus:

Students will be able to:

- make capacity measurements,
- collect observations and data,
- draw conclusions,
- use descriptive language,
- observe chemical change, and
- participate in the voting process.

Challenges:

How do the properties of the individual ingredients change when combined? How do the properties of Slime compare to the properties of Oobleck? Why do measurements need to be accurate?

Advanced preparation:

1. Dissolve 1 T. Borax powder in 1 quart of warm distilled water in a 2 liter bottle labeled "1". (32oz. of borax water solution).
2. Divide evenly into 6 disposal bottles small enough for children to handle easily. Label each of these bottles "1".
3. Empty 4 bottles of glue into another 2 liter bottle labeled "2". Rinse each glue bottle with 4oz. of warm distilled water and add to bottle "2". (32oz. of glue water solution). This provides enough solution for 30 students working in pairs.
4. Add 40-60 drops of food coloring to the bottle labeled "2". (Yellow is not a recommended color based on student reactions to touching yellow slime). Too much food coloring results in discoloration of students hands.
5. Divide evenly into remaining 6 disposable bottles. Label each of these bottles "2".
6. Prepare cups for students to measure ingredients. Mark a 2oz. line on 15 plastic cups labeled "1" to be used for the Borax solution and 15 plastic cups labeled "2" to be used for the Glue solution. Each pair of students need a cup "1" and a cup "2".
7. Prepare the bowls by writing the recipe or label ($1 + 2 = 3$) on the rim of each bowl. You need one bowl per pair of students.

Materials and Equipment:

- 4 - 4oz. bottles white glue (not school glue)
- 2 - empty 2 liter bottles (laundry section of supermarket)
- 1 T. Borax powder
- distilled water
- zip top sandwich bags
- food coloring (yellow not recommended)
- clear plastic 3oz. cups (1 per student)
- plastic bowls (not styrofoam! 1 per pair)
- stir sticks (1 per pair)
- 12 disposal bottles
- felt-tipped permanent marker

***The same cup cannot be used for measuring both solutions since the chemical change will occur in the cup. An easy way to prepare a large number of cups is to place 2 oz. of liquid in a cup. Place this cup next to an open weave basket. Insert a felt tipped permanent marker through the weave of the basket just at the right location to mark the level of liquid in the cup. Holding the marker steady, mark each cup.

8. Label each zip top storage bag with a student's name. This will be used for storage and transportation of each student's piece of Slime.

9. Slime lasts longer when refrigerated.

Procedure:

1. Begin by showing all the students a bottle of liquid "1" and a measuring cup labeled "1". Have students predict the task. Remind them of safety and measurement procedures such as: cups on a flat surface, pouring slowly, reading from eye level, keeping all foreign objects out of the bottles of liquid to reduce contamination, and which senses are safe to use. No tasting is allowed!

2. Divide your class into teams of two. One student is in charge of liquid "1". Student one should measure liquid "1" and lead the discussion of its characteristics. The other child plays the same role for liquid "2".

3. Have each pair decide on two sight, sound, smell and touch words that describe the attributes of each liquid. Discussion should begin with the pairs and expand to include the whole class with the teacher recording class observations.

4. After students have thoroughly explored and discussed the attributes of both liquids, give each pair a stir stick and a bowl labeled "1 + 2 = 3". Have them predict the task. Discuss how the math sentence used to label the bowl acts as their recipe. Remind them to make careful observations. Using their stir stick, slowly stir liquid "2" into liquid "1" which has already been poured into the bowl. Do not over-stir! Lift the thick material or "Slime" that forms in the bowl due to the chemical reaction of liquid "1" and "2". Holding this Slime over the bowl, knead it until it feels dryer. Discuss in pairs, then as a class, the changes that occurred as the ingredients were mixed. How is Slime like liquid "1"? How is Slime like liquid "2"? How is it different from each liquid? Divide the Slime between the children and explore the attributes of this new material. End with a class discussion of the attributes discovered.

5. As students continue to play with their Slime, read from *Bartholomew and the Oobleck* excerpts which emphasize the attributes of Oobleck.

6. Have each student decide if Slime and Oobleck is the same or different. Record student opinions, making sure each child gives their reasoning as well as their opinion. These results can then be discussed or graphed. The child's answer of "Yes" or "No" is not as important as the reason the child decided

Q How does slime act when you squeeze it?



Q How does slime act when it's sitting in your hand?

Q Can you name other substances that have properties similar to slime?

upon that answer. A typical explanation might be "They are both green." or "Oobleck is very sticky and Slime is not".

Assessments:

- Can the children support their opinion during the voting? Keep your focus on the reason for the answer instead of the "correctness" of the answer.
- Do the children use descriptive words? The correctness of descriptive words are not as important as the child's participation in drawing conclusion supported by evidence from their observations.
- You can tell the accuracy of their measurements from the quality of the appearance of their slime.
- Use questioning strategies to lead children to problem solve production problems.

Further Challenges:

- Make green goo. Two sources of the recipe are: Crocker, B. & Fleege, P. (1993) and *Science Experiences for Pre-Schoolers: CESI Sourcebook IV* page 32-33.
- Have children compare Green Goo to slime and Oobleck.

Resources/References:

Children's Books:

Seuss, Dr. (1950). *Bartholomew and the Oobleck*. New York, NY: Random House.

Teachers' Books:

Carin A. and Sund, R. (1989). *Guided Discovery Activities for Elementary School Science*. Columbus, Ohio: Merrill Publishing.

Crocker, B. and Fleege, P. (1993). 1 + 2 = 3: Distinguishing chemical and physical changes. *Science Activities*, **30**, (2).

Fleege, P. and Crocker, B. (1992). *Hands-on Slime*. Science and Children. **30** (1).

From the Smithsonian Institute. (1987). *Science Activity Book*. New York, New York: Galison Books.

Liem, T. (1989). *Invitations to Science Inquiry*. 2d ed. El Cajon, California: Science Inquiries Enterprises.

Sherwood, E., Williams, R. and Rockwell R. (1990). *More Mudpies to Magnets*. Mt. Rainier, Maryland: Gryphon House, Inc.



The Authors:

Pamela O. Fleege, Ph.D. is an Assistant Professor of Early Childhood Education at the University of South Florida, Tampa.
Betty Crocker, Ph.D., is an Associate Professor of Science Education at the University of North Texas, Denton.

Let's Make a Landfill

by JoAnn DeVito and Judi Wandres

18

Literature:

The Paper Bag Prince by Colin Thompson

Focus:

A sanitary landfill is a properly engineered site to which trash is transported. At the landfill it is compacted with bulldozers and heavy machinery. Rainwater will not flow through a landfill and pollute the surrounding ecosystems. The landfill is covered with soil to keep out rodents, air, and vermin.

A landfill does not produce much pollution or disease and is not unsightly. In some places, swamps and marshes have been filled with garbage and used as parks, ski slopes and even building sites. Unfortunately, in many areas, landfills have been developed that have resulted in the destruction of valuable ecosystems. In addition, many landfills are at capacity and can hold no more trash. Moreover, many valuable resources find their way to landfills and cannot be reused or recycled. It is important for students to see that while landfills have their good points, they are also detrimental to the environment in many ways.

Challenges:

How can you use the materials given to design and construct an efficient landfill?

Can you prevent the leachate from traveling through the layers of your landfill?

Procedure:

1. Use individual knowledge charts or class chart to list prior knowledge about landfills. At the end of the activity list new knowledge.
2. Show "The Rotten Truth" followed by a discussion on landfills. Add to knowledge charts.
3. Read *The Paper Bag Prince*.
4. Create classroom landfills. Start with two empty two liter plastic soda bottles. Remove the labels from the bottles. Cut the bottles as illustrated. Cover the top of one bottle with a netting or mesh (old pantyhose work well) and secure with a rubber band. Assemble the "landfill" as shown in the illustration.
5. Place a piece of masking tape on the side of the bottom piece (used to hold the landfill upright and catch the leachates). Mark with centimeter increments.

Materials and Equipment:

- video, "The Rotten Truth" (3-2-1 Contact Video)
- soil (1 lb. coffee can per team)
- clay or playdough, one can per team
- sand (2 cups per team)
- gravel (1 cup per team)
- cheesecloth (8 inch square)
- sponges - cut into small pieces (3 per team)
- red food coloring (to simulate leachate) (1 bottle per team)
- plastic sheets (to cover desks) (1 per team)
- soda bottles - cut in half (1 per team)
- rubber bands (1 per team)
- paper towels
- measuring cups (1 per team)
- markers or masking tape (1 per team)
- landfill observation sheets

Q What is a landfill?

Q What goes into a landfill?

6. Cover desks with plastic sheeting. Divide the class into teams. Give each team an empty "landfill". They must decide how to layer the landfill and where to place the garbage.
7. After the teams have assembled their "landfills" have them simulate rainfall by pouring one half cup of water through them. Teams should observe their "landfills" carefully and record results on the Landfill Observation Chart. each team should repeat this step three more times.
8. After students have recorded their results they can compare their team design with other teams. They should be prepared to describe the strengths and weaknesses of their team's design. Reporters share information.
9. Allow time for discussion
10. After the class discussion, have the class decide what the best design for a landfill would be.
11. Experiment to see if the "best" design works better. Discuss the results of this experiment, and decide how the design could be improved.



A *couplet* is a verse composed of two lines, where the last word of each line rhymes.

Assessments:

- Each group will describe the strengths and weaknesses of their design.
- Each group will compare results.
- Students will list new knowledge on charts.

Further Challenges:

Poetry Analysis - *Garbage* by Bill Steele

- What would life be like when there's "nothing left to walk upon, or care about, or see, or touch, or do?" How important are these things for life?
- What can you do to be sure that there is "something left"?

Writing Couplets - "Sarah Cynthia Sylvia Stout Would Not Take the Garbage Out" from *Where the Sidewalk Ends*

- Read the poem, directing student attention to the rhyming pattern. Explain that this poem is an extended version of a couplet. A writer may choose to write one couplet or a series, as Silverstein did, to construct one poem.
- Using the starter lines provided to construct several sample couplets on the board. First, you may want the students to brainstorm a list of words that rhyme with the last word of each phrase below.

Starter Line Examples:

The garbage was scattered from New Jersey to California...

Bottles, jars, cans and jugs...

Drippy faucets, water we waste...

Polluting our oceans from shore to shore...

Resources/References:

Children's Books:

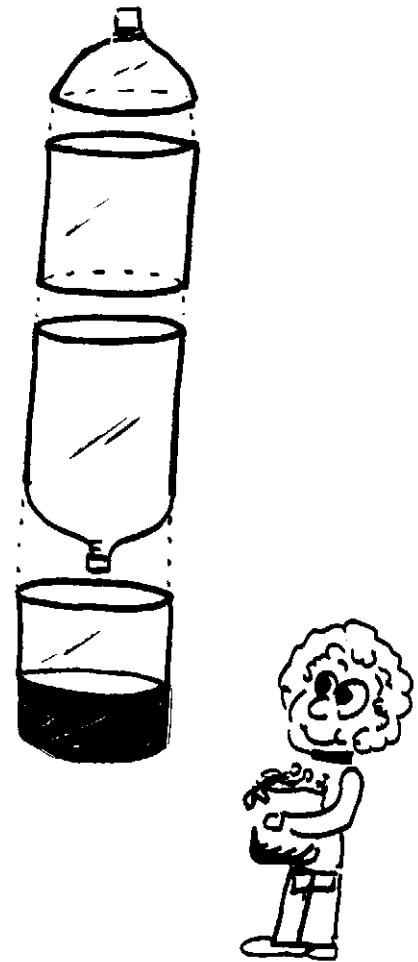
Silverstein, S. (1974). *Where the Sidewalk Ends*. Harper & Row

Thompson, C. *The Paper Bag Prince*. New York, NY: Knopf

Teachers' Books:

Haddingham. *Garbage*. New York, NY: Simon & Schuster.

Science Teams: Lessons in Environmental Science and Cooperative Learning, Rutgers, The State University of NJ Consortium for Educational Equity.



The Authors:

JoAnn DeVito - K-6 Math, Science and Technology Teacher Trainer, Matawan, New Jersey.

Judi Wandres - 5th Grade Gifted and Talented Teacher, Matawan, New Jersey.

19

GARBAGE GRABS 'EM! (How to Get Your Students Thinking Ahead)

by Karen Farley

Materials and Equipment:

collection of "trash" items such as: egg cartons, oatmeal cartons, cereal boxes, plastic soda bottles, fruit baskets, cardboard tubes, plastic throw away containers, milk containers, etc.

Optional Materials and Equipment:

- stapler
- brads
- yarn
- string
- glue
- metal rings
- scissors
- decorative materials:
- crayons
- markers
- paints
- glitter
- construction paper

Good As New talks about a ragged, dirty teddy bear which the parents want to discard, but the grandfather of the owner helps clean and repair the toy. Because the boy loved his teddy bear so much, repairing the bear makes more sense than purchasing a brand new one.

Literature:

Good As New by Barbara Douglass

The Year of the Perfect Christmas Tree by Gloria Houston

Focus:

Through a collection of home-generated solid waste students quickly recognize the problem facing the entire world: what to do with solid waste? Observations of collected solid waste, "trash items" can lead to discussion of front-end product packaging, first use of materials, recycling, reuse, and conservation. Students participate in a "**Reinvention Convention**" in which they take items usually discarded to create usable "new again" items.

Challenges:

How are goods packaged?

How is packaging disposed of?

What happens to packaging (solid waste) when the goods inside are used?

What can be done with materials normally thrown away?

What is the difference between recycling and reusing?

In what ways does reusing materials help the solid waste situation?

Procedure:

1. As a class establish a definition of packaging. Their definition should include an understanding that packaging is the "container" items are sold in. Brainstorm examples of packaging (i.e. egg cartons, paper towel tubes, boxes, bags and bottles).
2. Discuss how "packaging" is disposed of. Introduce the concept of solid waste
3. Over a period of two weeks, have students bring in all packaging materials usually considered to be "trash items." Encourage children to bring in clean "trash items". Caution children to avoid glass and sharp items. Place their "trash items" on display, preferably where others in the school can see the collection. This will raise the curiosity of other students and teachers and allow your students to verbalize what their class is doing.

This particular activity is one which lends itself to getting parents involved. Students are asked to bring materials from home and collect data on family habits. Record on a calendar the "packaging" collected each day. Data should include the names of

the "trash items" and the quantity. This information is an excellent source of data for graphs.

A variation of this method of collection would be to collect one type of disposable--such as plastic milk bottles--which students bring in from their houses during a specific period, such as a week. One such gathering for a second grade class resulted in a jungle gym two-thirds filled! (We wrapped plastic wrap around the outside of the bars to contain the bottles and put up signs explaining what we were doing.)

4. Observe the "trash items" collected. Brainstorm ways to group them. Ideas include materials they are made from, use, size, color, ability to be recycled, and biodegradability. Items can be graphed and enumerated by type of container, type of material or some other rating system chosen by the students.

5. Students will quickly grasp the scale of solid waste disposal when they see a two-week pile of trash building up in their classroom or hallway.

6. Class discussion needs to take place so that students can make an informed decision about whether it is better to recycle the "trash items" or try to reuse them in a creative way.

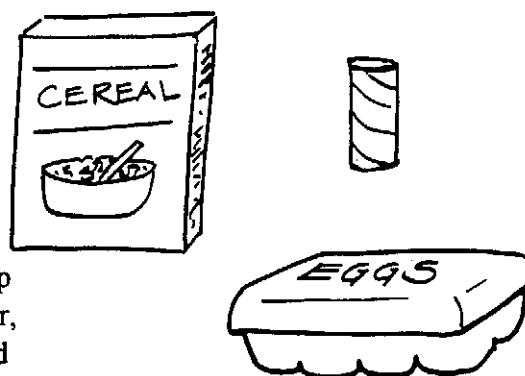
7. Read *The Year of the Perfect Christmas Tree*.

9. Challenge the students to take a "trash item" and reuse it in a way other than what it was originally used for. Encourage creative and practical alternatives. For example they could find an item and "reinvent" it into something they could use everyday. Children can brainstorm some new uses for class collected "trash items."

10. Students should do basic research on the material their "trash item" is made of (i.e. plastic, cardboard, wood, paper, etc.). Time (up to 2 weeks) is needed for most students to pick a "trash item", think about and research its composition, design a new use for the item, and construct that new item. At the same time, students will be using class discussion time and research to examine more global issues of solid waste management.

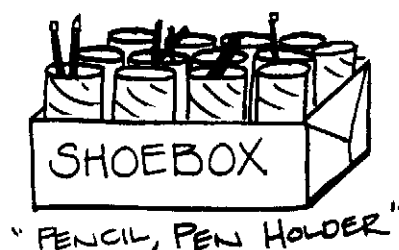
11. Journal entries are used to trace the first use of the material (what it was originally used for), how the student is going to reuse the item, an explanation of *why* it is better to reuse the material than throw it away, and ideas for other reuse products. Students are called upon to observe, classify, write, produce original artwork, design solutions, synthesize information, identify resources, plan and construct usable items, demonstrate in a very tangible way how to reuse something, and verbalize a logical argument for the reinvented item.

Q What is the most common container collected?



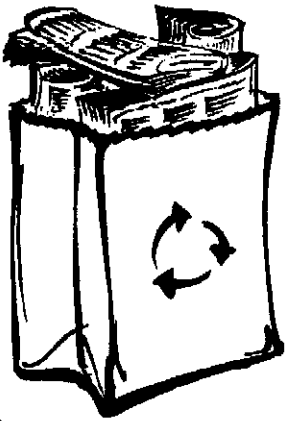
The characters in the *Year of the Perfect Christmas Tree* are so poor during the time the father is away at war that the mother and daughter live quite frugally. When the girl is chosen to be the Christmas angel and needs a special dress, the mother reuses her wedding dress for her daughter.

Q How many different ways can a toilet paper tube be reused?





Q What items disintegrate when buried?



Q How many miles does our trash travel?



12. Parents can be called upon to help their child design and construct the "reinvented" product. No matter who spends the most time on the project, there is a rich learning opportunity for the entire family.

13. Host a "**Reinvention Convention.**" Parents should be invited to visit and view the objects the students have invented. Students should be on hand so that they can show their journals and explain their thoughts as they solved the solid waste problem. Hopefully, a school-wide display can be made to showcase the work of the students.

Assessment:

- Students will be involved in a variety of alternative assessments which range from product outcomes (the reinvented item), to written product (journals), to oral explanation (description of process at the Convention), to systematic observation and classification (graph of trash pile). Students can define what learning outcome they will accomplish and be assessed against that goal. Additionally, students will have the benefit of working with peers, parents, and science resource people outside the school to solve a tangible, real-life problem.

Further Challenges:

- Discussions in the classroom over the period of trash collection revolve around what kinds of materials are used and what usually happens to them. Scientific investigations within the classroom can include biodegradability using common non-toxic solvents (water, vinegar), burying them in soil, placing materials in plastic sealed containers, researching typical product life in a landfill and current problems facing landfills.
- Discuss other ways items can be purchased to avoid packaging.
- Local science resources such as landfill managers, environmental scientists, solid waste companies, and county extension agents can be included in investigations and research with students to help identify local solid waste conditions. Students can contact local officials to inquire as to regulations and the overseeing solid waste disposal. Regional offices of the Environmental Protection Agency for the federal level and state offices of solid waste management and environmental protection can lend assistance in identifying the local offices. See also the References section for additional ideas on science resource people to contact.
- Additional research questions could include:
 - How does a landfill affect our water, soil, and air?
 - Where are local landfills?

- How can my family reduce the amount of materials in the landfill?
- Who might know what goes into the landfill?
- Who has control over what can be put into a landfill?
- How much does it cost to throw away materials and how much money could be saved by a reuse idea?
- What kinds of effects does trash have on wild animals?
In a future world without many trees, what could we build homes from?
- Debate and discussion can extend into all disciplines and include a variety of resource people within the classroom. Many agencies exist which support the idea of reduction of waste, recycling, and reusing of materials. These solid waste experts can be called upon to add depth to student inquiries.
- Is solid waste a problem in other countries? What are other countries doing about landfills and reusing materials? Depending on the interests and capabilities of students, additional research can be done on what solid waste problems the United States and world face. A book which is useful for more global class discussion is *Just a Dream*. The book describes a boy with little concern about his environment who takes a dream journey into the future where he sees mountains of waste, smoke-filled air, and crowded freeways. Upon awakening, the boy has a greater understanding of the place he has in the present to take care of the earth.
- Research products that are made of reused/recycled materials. You might be surprised by the discoveries here.



Many materials exist on solid waste management; however, because this project is intended to connect students to *local* solid waste problems, it is suggested that local resources be used. These would include city, county and state departments of health, private solid waste companies, county extension agents, county road commissioners, city government officials, environmental specialists at universities, community colleges, and other governmental offices. Resources such as these provide first-hand information relevant to the local level of concern.

Resources/References:

Children's Books:

- Douglass, B. *Good As New*. William Morrow.
- Houston, G. *The Year of the Perfect Christmas Tree*. Dial Books.
- Madden, D. (1986). *The Wartville Wizard*. Macmillan.
- Van Allsburg, C. (1990). *Just A Dream*. Houghton-Mifflin.

The Author:

Karen Farley is a Senior Training/Technical Assistance Associate, Southwest Educational Development Laboratory.

Mission Impossible

by Judi Wandres and JoAnn DeVito

Materials and Equipment:

- Video - "Bottom of the Barrel" (3-2-1 Contact Video)
- For each team:**
- 2 measuring cups (1 for oil, 1 for water)
- 1 aluminum pan
- 6 or 7 pipe cleaners
- 1/4 cup vegetable oil
- blue food coloring
- plastic sheeting
- medicine dropper
- 2 styrofoam balls (1 sm., 1 lg.)
- 2 pieces nylon stocking
- 1 paper cup (3 oz. or 5 oz.)
- teaspoon
- liquid dish detergent (one squeeze)
- 1 coffee can of sand
- 12-inch piece of string
- 2 1/2 cup water
- 3 pieces sponge (1-in. square)
- toothbrush
- 3 feathers
- paper towels
- safety goggles (each member)
- scissors
- popsicle stick



Q What would happen if the transporting of oil was stopped? Why?

Literature:

Sea Otter Rescue: The Aftermath of an Oil Spill by Roland Smith

Focus:

A major oil spill provides dramatic evidence of the impact of environmental pollution on wildlife. Feathers are damaged. Embryos are killed when oil seeps into eggs. Fish suffocate because their gills become clogged. Marine and land animals die from ingesting oil-contaminated water and food.

Oil is a non-renewable resource, and recovery is just as important as cleanup. We are all part of the oil spill problem because we all use oil and oil products. The expense of cleaning up oil spills is directly and indirectly felt by all taxpayers. (Point out that students are taxpayers each time they purchase an item that is taxable).

Bio-remediation, the use of microbes, is currently being used in oil spill cleanups. Specific microbes are cultivated to eat different kinds of oil, and are dispatched to different parts of the world, according to the type of oil spilled. Such microbes are also being used in products to unclog drains in the home.

Challenges:

How do you contain and reclaim the oil in an oil spill?

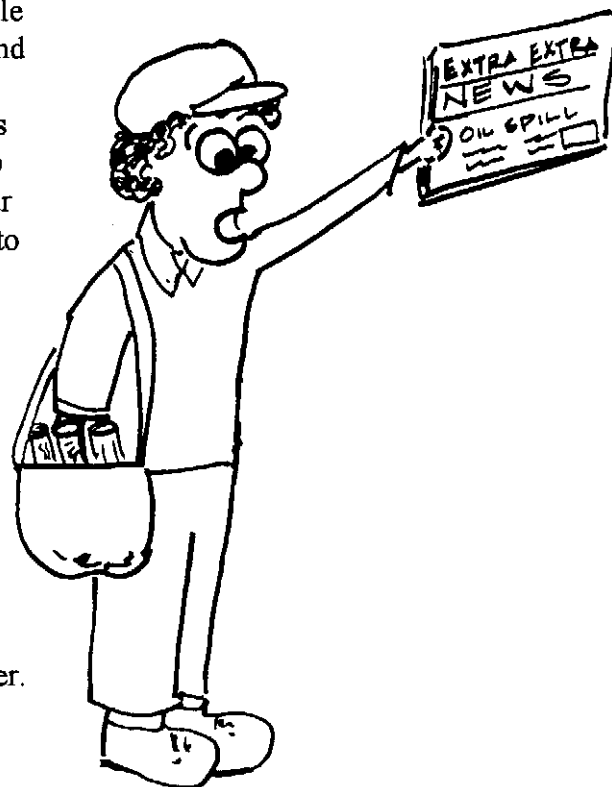
How do you clean up what you can't contain?

What is the effect of a major oil spill on wildlife?

Procedure:

1. Write the words 'Valdez, Alaska' on the board. Tell students Valdez is the site of the worst non-natural environmental disaster in the United States.
2. Use individual knowledge charts or a class chart to list prior knowledge about oil spills. At the end of the Activity, list new knowledge.
3. Begin lesson by reading page 29-31 in *Sea Otter Rescue: Aftermath of an Oil Spill* as motivation, or read *Prince William*.
4. Optional - show parts 1 and 2 of the video, "Bottom of the Barrel" (10 minutes)
5. Present the following hypothetical problem to your students:

You are a marine biologist and have been called in to handle an environmental emergency. An oil tanker has run aground and is leaking 850,000 gallons of oil into the Delaware River. Your expertise is needed to decide the best methods of containing and reclaiming the oil, as well as cleaning up what is left. After experimenting with the materials in your lab today, you are to determine the most effective method to do the job.



6. Oil Spill Clean Up:

- a. Cover the desks with plastic sheeting to protect from spills.
- b. Materials managers get supplies.
- c. Pile sand high at one end of the pan to simulate a shoreline. Add 2 1/2 cups of water to the pan. Add 2-3 drops of blue food coloring to water.
- d. Make a "bird" by using styrofoam balls, pipe cleaners, and feathers.
- e. Simulate an oil spill by adding 1/4 cup of oil to the water.
- f. Put the bird in the water
- g. Create a current by *gently* moving the water with the spoon or stick.
- h. Try to contain the spill using any of the materials you have.
- i. Collect as much oil as possible in the paper cup. Collect only *oil* in the cup, not ocean ! Measure and record amount reclaimed.
- j. Squeeze one or two drops of detergent into your ocean. Observe what happens.
- k. Attempt to clean up the oil spill and the bird using the materials you have. Remember, you are a team and you need to discuss all of your strategies.
- l. The recorder should be taking notes as to the effects of your attempts.
- m. The reporter will share your team's efforts and results with the class.

7. Discuss with students their plans for the recovered oil and the expense involved in the clean-up project. *If the experiment went well, it should be approximately half of what was initially spilled.*

8. Discuss how wildlife is affected by an oil spill.

9. Optional - Show the rest of the video "Bottom of the Barrel".

Q What would the consequences be if an oil spill was not cleaned up?

Members of each team write at least one of the following types of articles for the front page:

News Article:

1. Reporting on the oil spill
2. Reporting on the clean up, using the team's experiences

Feature Article:

1. Effect of oil spill on wildlife

Editorial:

1. Who pays for the clean up ?
2. Who is responsible for the oil spill ?
3. Prevention of oil spills

Editorial Cartoon

Water
Blue, clean
Flowing, renewing, sparkling
Life, fun, death, expense
Stagnating, Contaminating, Killing
Dirty, toxic
Pollution

The Authors:

Judi Wandres - Fifth Grade Gifted and Talented Teacher, Matawan, New Jersey.

JoAnn DeVito - Math/Science Teacher Trainer grade K-6, Matawan, New Jersey.

Assessments:

- Add to prior knowledge chart
- Groups will compare amounts of recovered oil and discuss strategies used.

Further Challenges:

"Extra! Extra! Read All About It!"- each team will design and write the front page of a newspaper containing articles about an oil spill.

Review or teach the 5 W's

Teach what constitutes an editorial

Headlines: Stress use of attention-getting phrases

By-lines: explain how to write a by-line.

Students will display and share their newspapers (Optional: publish them on a computer, and print out copies to be distributed).

Poetry - Diamante poetry (Diamond-shaped contrast poem)

7 lines of poem

- Line one Noun
- Line two 2 adjectives, describing the noun in line one
- Line three 3 -ing verbs about the noun
- Line four 2 nouns that related to line 1, 2 nouns that relate to line 7
- Line five 3 -ing verbs about line 7
- Line six 2 adjectives about line 7
- Line seven Noun, opposite of noun in line 1

Resources/References:

Rand, G. (1992). *Prince William*. New York, NY: Henry Holt.New York.

Science Teams: Lessons in Environmental Science and Cooperative Learning, Rutgers, The State University of New Jersey Consortium for Educational Equity.

Smith, R. (1990). *Sea Otter Rescue: Aftermath of an Oil Spill*. New York, NY: Cobblehill Books/Dutton.



What Shall We Do With The Wild Horses?

21

by Meghan Twiest

Literature:

Misty of Chincoteague by Marguerite Henry

Focus:

Students will explore the issue of wildlife management from a variety of perspectives and use problem solving skills to resolve an issue.

Materials and Equipment:

- role cards
- signs for the tables to identify the groups

Challenges:

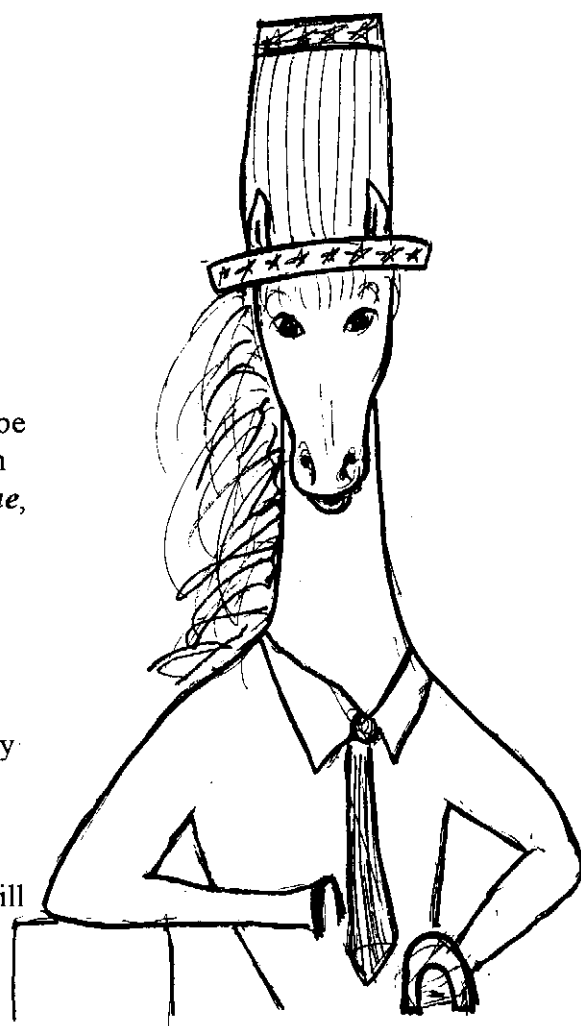
How much intervention should take place in reference to the wild ponies?

Should "Pony Penning Day" continue?

Students will also appreciate that all viewpoints must be considered when dealing with these issues.

Procedure:

1. Read and discuss *Misty of Chincoteague*.
2. Introduce the activity after students have read *Misty of Chincoteague*. Explain to the students that there has been some recent opposition to the idea of "Pony Penning Day" and some community members do not feel that the wild horses should be bothered. Tell the students that they will be examining this issue by becoming representatives of certain groups. After the students have read *Misty of Chincoteague*, they will be familiar with the situation and will have empathy for the wild horses.
3. Tell the students that every ten years the board has been directed to examine the situation of the wild horses on the island of Assateague. Concerns have been raised about whether animals are being treated humanely, whether "Pony Penning Day" should be eliminated, and how the resources of the island should be allocated. The Chincoteague Town Council will hold a Town Meeting so that this can be discussed. They have the power to decide how the town will respond to these issues.
4. Divide the class into six groups to represent: 1) The Assateague Wild Horse Association, 2) The Chincoteague Naturalists, 3) Boy Scout Troop #384, 4) the Chincoteague Tourist Bureau, 5) Federal Fish and Game Commission, and





6) the Chincoteague Town Council. Divide the class into the six groups mentioned above: Give each group one Role Card for their group only.

The Chincoteague Town Council will determine the fate of "Pony Penning Day" and what will happen to the wild horses of Assateague. The other five groups will discuss what they want the Town Council to do. Each group should elect 3 spokespersons to present the group's viewpoint to the council.

The town council will hold a town meeting so that the groups will have the opportunity to make their opinions public. After listening to the various groups, the council will decide how to handle the situation.

5. Tell groups (except for the town council) that they will have 20 minutes to discuss and plan a presentation explaining how their group feels the situation should be handled. Emphasize that students should try to put their personal feelings aside and play the roles described on their Role Cards. Presentations will be limited to 3 minutes and should be based on facts not opinions.

6. Review the directions and make sure council members understand their duties. Let the Chincoteague Town Council conduct the Town Meeting, deliberate, and announce their decision.

7. A class discussion will follow. Questions you might want to raise include the following:

- Why do you think the town council make the decision they made?
- What additional information would have helped your group prepare its presentation or reach a decision?
- What did you learn about solving environmental problems by taking part in this activity?

Assessment:

- Students will be assessed based on the preparation of the group, the presentation that is made, and the discussions that ensue at the town meeting. Questions in the closure can be used to determine whether students have understood the complexity of issues that on the surface can seem to have a clear solution.

Further Challenges:

- After the activity is conducted, they can read more factual information about the horses by reading *Island of Wild*

Horses, and *The Little Wild Ponies*. Students can then read Henry's other two books about the horses of Assateague, *Stormy*, *Misty's Foal*, and *Sea Star*.

- Have the students compare the predicaments of the horses of Assateague with those of the wild mustangs of the West. Also have them investigate their pasts to see if they came from the same descendants. This would be an excellent basis for discussion since there are many similarities as well as differences concerning the background and current situations.

Resources/References:

Bullaty, S. & Lomeo, A. (1987). *The Little Wild Ponies*.

Ancona, G. (1992) *Man and Mustang*. New York:

Macmillan Publishing Company.

New York: Simon & Schuster Publishing.

Henry, M. (1947). *Misty of Chincoteague*. Chicago: Rand McNally & Company.

Henry, M. (1949). *Sea Star*

Orphan of Chincoteague.

Chicago: Rand McNally & Company.

Henry, M. (1963). *Stormy*,

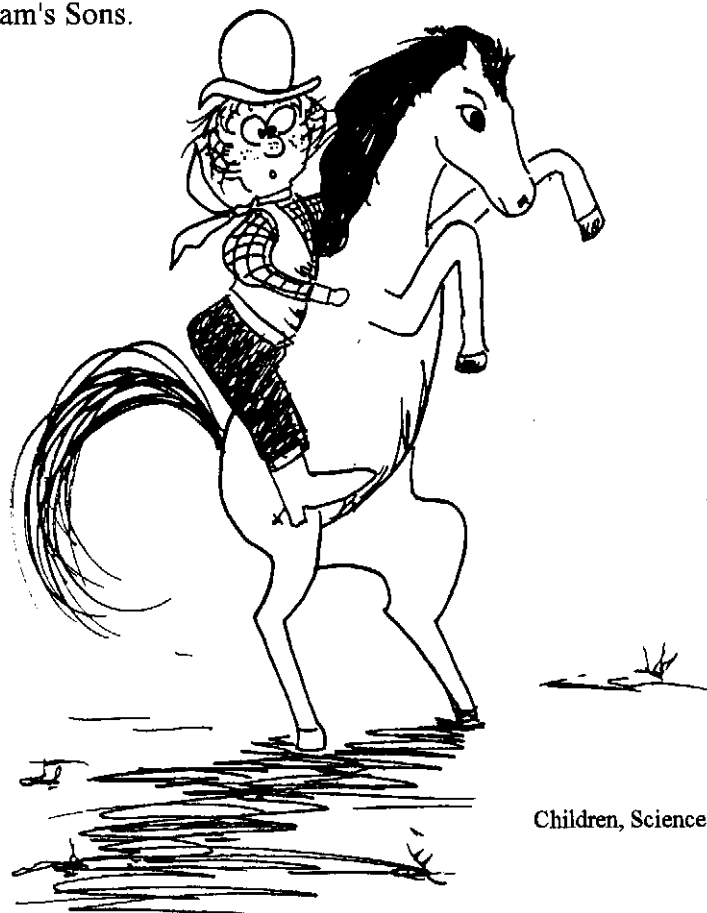
Misty's Foal. Chicago: Rand McNally & Company.

Scott, J. & Sweet, O. (1987). *Island of the Wild Horses*.

New York: Putnam's Sons.

The Author:

Meghan Twiest, Associate
Professor, Indiana University of
Pennsylvania.



ROLE CARD: CHINCOTEAGUE TOWN COUNCIL

As Chincoteague's elected governing body, you have the power and the responsibility to decide how the town council will act on this problem. You realize that Pony Penning Day draws crowds of 50,000 tourists to the area and that the town greatly benefits from the money that is generated. However, you are also concerned about the unique environment that supports the horses and the welfare of the horses themselves. Since this is an election year, you are particularly sensitive to the opinions that are presented by the townspeople.

While the other four groups are meeting to plan their presentations, you will meet to decide how you will go about choosing the best proposal and think of additional questions you may want to ask.

Your tasks, therefore are to:

1. Elect a chairperson to preside over the Town Meeting. The chairperson will introduce the members of the council, call groups before the council to make presentations and maintain order during the meeting.
2. Choose a timekeeper to make sure that no group exceeds their three minute time limit.
3. If you wish, you may ask 2 or 3 questions of each group.
4. After all groups have made presentations, meet to determine what will be done about the horses and Pony Penning Day. Remember, you will not choose a winning group. Instead, you will decide what steps, if any, Chincoteague will take to handle the problem.
5. Report your decision to the townspeople and explain why you made this decision.

ROLE CARD: BOY SCOUT TROOP # 384

You are representing a Boy Scout Troop representing a group who released several "sika" deer on the island of Assateague 20 years ago. These exotic deer from Japan have been very successful living on the island. So well, in fact, that they must sometimes be "weeded out" so that the whole herd is not weakened. You want to make sure that these deer continue to live here so that they do not become endangered. Since they compete for food directly with the wild horses, you are afraid this may be a problem, and want to be involved in any decision that impacts the wild horses.

ROLE CARD: THE FISH AND GAME COMMISSION

There are many wild birds that live on the island, especially wild fowl such as ducks, swans and geese. Since it is a wildlife refuge, it is your obligation to oversee this area. You would like to restrict the movement of the wild horses by erecting fences that would prevent the area around the ponds from being trampled. You feel that the wildfowl should be protected and that the horses should have a smaller share of the resources. You don't want people to find out that in the past when fences were erected, horses drowned in a hurricane because they could not reach higher ground. (If others do find out, you would try to prevent this from happening again.)

ROLE CARD: THE CHINCOTEAGUE NATURALISTS

You represent a group of naturalists and biologists who are against Pony Penning Day". You feel that humans should not be a controlling factor in any wild population. Your organization cites studies showing populations of rabbits, deer and other species are regulated by weather conditions and availability of food and that the number of individuals within a group naturally fluctuates. (Predation can no longer be considered a contributing factor, since most of these predators have been eliminated). Weaker animals die and the strong survive. You feel that the animals on the island should be left alone. You are also strongly opposed to the idea to allowing the public access to the island to view the horses and use the beaches. (You have heard a rumor that the Fish and Game commission are responsible for the death of several horses in the past.)

ROLE CARD: THE CHINCOTEAGUE VOLUNTEER FIRE DEPARTMENT

You strongly disagree with the naturalists because they are not considering that the range and the food on the island are permanently restricted. You feel you respect the "wildness" and the freedom of the horses. If the winter is particularly severe, your organization drops hay onto the island and volunteers chop holes in the ice of freshwater ponds. This is the only way they interfere with the horses, other than "Pony Penning Day" Since 1924 at the Firemen's Carnival and Auction, the horses have been herded over to the Mainland. About 40 younger horses are auctioned off, with the profits going to buy equipment for the fire fighters and winter fodder for the horses. You want to keep this tradition and see the horses as a great asset for the area.

ROLE CARD: THE CHINCOTEAGUE TOURIST BUREAU

Every year the wild horses of Assateague are rounded up into one large herd by volunteers on horseback. This herd is then driven across the Assateague Channel, which is an easy swim for these strong horses. Huge crowds, as many as 50,000 wait for and watch the wild horses run through the streets. About 40 horses are then auctioned off to the highest bidders and the rest return to the island. This event, which is famous nationwide brings in more revenue than any other yearly event. The town thrives on providing transportation and tours to observe the wild horses and use the beaches on site that has been designated a wildlife refugee. The tourist attraction attracts a family crowd, unlike many other types of tourist attraction such as gambling or large scale sports and you feel that your community would not survive without this tourist attraction Federal Fish and Game Commission.

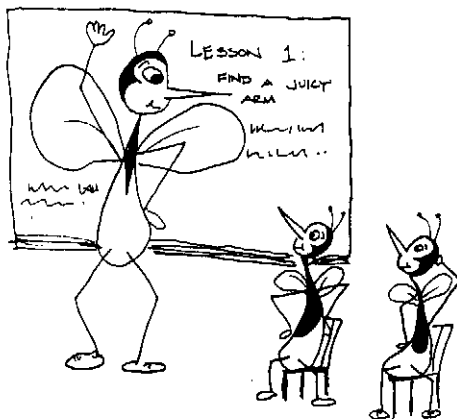
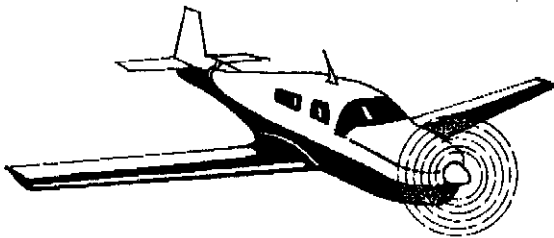
What To Do When There's No Way Out

by Donna Gail Shaw and Kathleen D. O'Dell

Materials and Equipment:

- copies and a wall chart of "The Sure-Fire Problem Solver" and the scientific method
- learning journals

Q How do you fly a plane?



Q What's for lunch?

Literature:

Hatchet by Gary Paulsen

Focus:

"Scientific habits of mind can help people in every walk of life to deal sensibly with problems that often involve evidence, quantitative considerations, logical arguments, and uncertainty..." (*Science for All Americans*, p. vi) Whether a consumer is trying to decide which brand of paper towel to buy or a doctor is trying to decide which medicine to prescribe, the ability to use critical thinking skills is at the very essence of problem solving. Scientific thinking skills include such things as observing, inferring, hypothesizing, classifying, predicting, controlling variables, interpreting data, and designing investigations. At the heart of scientific inquiry is the acquisition of accurate data through observation. The scientist then attempts to explain these observations in the context of the currently accepted scientific principles. Though there are no set steps that scientists always follow in their pursuit of knowledge, there are certain features of the scientific mode of inquiry that can be applied to everyday life. Using the book *Hatchet* as an example students are encouraged to practice the craft and art of problem solving with an emphasis on the use of scientific thinking skills.

Challenge:

Are there steps that can be followed to help in the problem-solving process?

What skills are necessary to be a good problem solver?

How can scientific habits of mind help to solve everyday problems?

Procedure:

1. Read and discuss *Hatchet*.
2. Assign teams to analyze the following events experienced by Brian, the main character in *Hatchet*.
 - a. acquisition of food
 - b. flying of plane after death of pilot
 - c. making of shelter
 - d. making of fire
 - e. making of tools (spear, bow, etc.)

- f. encounters with animals (mosquitoes, moose, skunk, wolf, etc.)

Each analysis should include identification of:

- a the specific problem,
- b the steps Brian used to solve his problem,
- c the scientific thinking skills used by Brian,
- d science knowledge that Brian used to solve his problem,
- e other science knowledge that might have been beneficial for Brian to know to help solve his problem.

3. Teams will share their analyses with the class and evaluate Brian's general science knowledge background as well as his use of scientific thinking skills.

4. Using chapter 4 from *Hatchet*, lead students on an exploration of all the information Brian takes in as he regains consciousness. What kind of things blocked his thoughts? What information did he ignore? Why do you think he ignored it? What were the consequences when he ignored information?

5. Discuss the importance of paying attention to all information when trying to solve problems. Discuss this as it relates to scientists as well as themselves. Have students write in their learning journals about a time when they ignored information and the consequences that resulted.

6. Introduce the "Sure-Fire Problem Solver". Compare this method to the method that is typically called the scientific method.

7. Find a letter to the editor from the local newspaper that appears to illustrate a faulty problem-solving process on the part of the writer. In their learning journals, students will analyze the information from the letter and try to define the problem. Then in cooperative groups, they will share information and agree on a problem definition.

8. Brainstorm problems that are common to the local community or state. Using the "Sure-Fire Problem Solver", try to determine solutions to the problems. It may be appropriate to share these solutions with the local media or governing body.

9. Of the problems identified in number 7, how many require some scientific knowledge to understand or solve? What scientific thinking skills were used in the formulation of solutions to the problems identified in number 7?

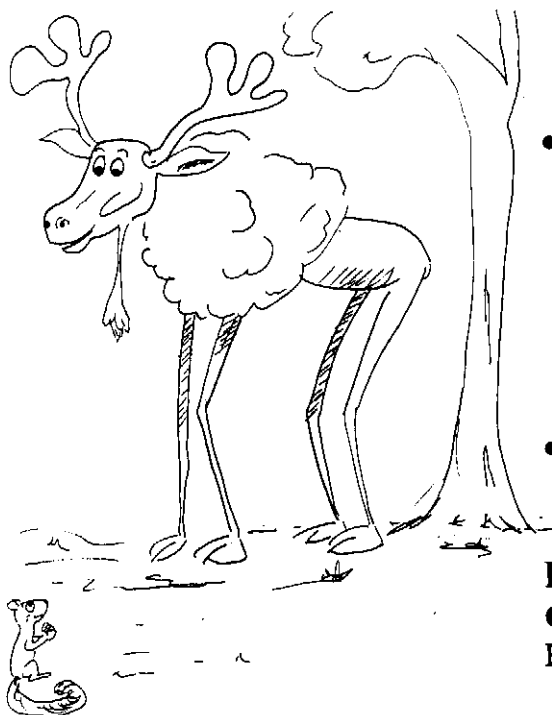
The Sure-Fire Problem Solver

1. Take a deep breath or two.
2. Focus on the problem which most needs solving. Define the problem: What exactly do you need to be able to do?
3. Let your mind become aware of information coming in: sensory information, memory, facts, and emotions.
4. Focus on the information coming in. Categorize it, organize it. Begin to evaluate it: Will it help solve the problem you have defined? Remember to include your emotions in this evaluation.
5. Using all the information you have available, decide on a solution that is as objective as you can make it.
6. Solve the problem.
7. Make a date with yourself. Name a specific time in the future when you'll think back over the problem and your solution. Have things changed? Is the problem different? Do you need to find a new solution?

The Scientific Method

1. Questions - Identify the problem, conduct some research, and state a hypothesis.
2. Test - Determine variables, design and conduct experiment, record results.
3. Analyze - Organize the data in the form of charts, tables and graphs.
4. Conclude - Interpret the data and form conclusions, re-evaluate hypothesis, and form new questions.

Q How do I use scientific knowledge?



Further Challenges:

- Discuss responses to the following questions. Why do we seem to lose our ability to think when we're scared or angry? What can we do when our brains go blank? Why can some people see several birds in the forest while their companions see none? How can two people say the same thing and still get into an argument about it?
- Provide students with short mystery scenarios. (Barrett suggests using Eric R. Emmet's *Brian Puzzler's Delight*, or Donald Sobol's Encyclopedia Brown mystery series.) Give the students some brief instructions and a limited time in which to solve the problem. Students should be encouraged to write down the steps they follow to solve the mystery in their learning journals. Each group gives a report on how they solved the mystery.
- Develop a role to solve Brian's problem of telling his father THE SECRET.

Resources/References:

Children's Books:

- Emmet, E. (1978). *Brian Puzzler's Delight*. Hillside, NJ: Enslow Publications.
- Paulsen, G. (1987). *Hatchet*. New York: Puffin Books.

Teachers' Books:

- Barrett, D. (1986). From "Thinking Man" to "Man Thinking": Exercises requiring problem-solving skills. *Activities to Promote Critical Thinking*. Urbana, IL: National Council of Teachers of English.
- Harmin, M. (1994). *Inspiring Active Learning*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Ruggiero, V. (1990). *Lessonpack for Creative and Critical Thinking*. Dunedin, FL: Mindbuilding.
- Rutherford, F., & Ahlgren, A. (1990). *Science for all Americans*. NY: Oxford University Press.
- Swartz, R., & Perkins, D. (1989). *Teaching Thinking: Issues and Approaches*. Pacific Grove, CA: Midwest.

The Authors:

Donna Gail Shaw, Associate Professor
University of Alaska Anchorage.
Kathleen D. O'Dell, Associate Professor
University of Alaska Anchorage.

Hunting Fossils

by Carol Van De Walle

23

Literature:

If You Are a Hunter of Fossils by Byrd Baylor, illustrated by Peter Parnall

Focus:

The skills emphasized include using observations and indirect evidence to formulate a theory, measuring and mapping. Students will also learn that digging fossils requires patience and care, and that fossils were formed at different time periods.

Challenges:

How does a paleontologist remove a fossil from the matrix? What can be learned by making careful observations of the location of the fossils?

Advance Preparation:

1. Prepare bones: remove all meat, boil until any remaining meat falls off or can be easily scraped off. Bleach for 15 minutes in a weak solution of bleach and water, about one tablespoon per gallon of water. Air dry. Since most fossilized bones are not whole you may want to cut or break some. Even smashing one or two with a hammer is effective.

Or gather fossils that can be found in your location.

Whenever possible, collect enough small fossils to give each student wanting one, one for their own collection.

2. Collect the boxes and margarine tubs. Line the paper containers with waxed paper. Place on newspaper. Another alternative is to place a large garbage bag on the floor as the fossil bed; sections could be cut from this. Be sure to number the "bed" sections so students know which section they have. See diagram.

3. Mix the Plaster of Paris and add about half as much sand. Stir.

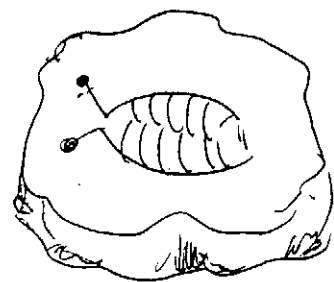
4. Pour into the containers. The depth will depend on the materials you want to cover and the amount of time students will have to remove it. Approximately one to four centimeters is sufficient.

5. Arrange "fossils" in the "matrix". Allow to dry overnight. The arrangement may represent one large fossil bed with each group having a part. You will want to decide the best way to place the bones or fossils, for example, jumbled representing a disturbed site, or organized so the animal can

Materials and Equipment:

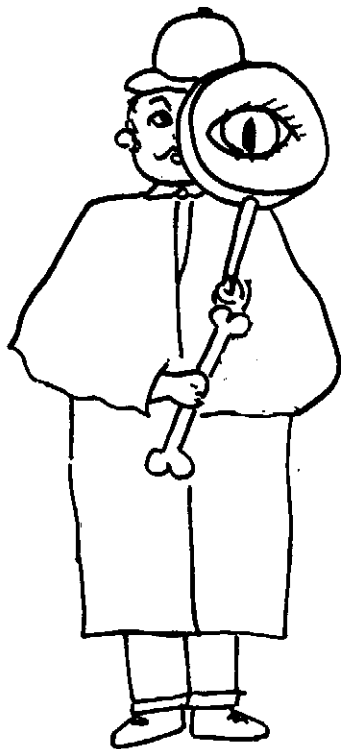
For each group of 2-4:

- a collection of fossils or bones that have been buried in a "matrix" (chicken or turkey bones that have been cleaned work well). Alternative: purchase plastic bones.
- probes, dental picks, small paint brushes for cleaning the fossils.
- wash tub/sink for final cleaning.
- graph paper
- For teacher preparations:
- Plaster of Paris (5 lbs. should be enough for a class)
- sand - several cups
- box lids, shoe boxes, or other small container (individual size containers would include small boxes and margarine tubs)
- cleaned bones or small fossils.
- newspapers and waxed paper. Alternative: large garbage bag; old books and tape to make ridge.



Q Why are the bones of many animals sometimes found all jumbled together?

Q What is a matrix?



be identified when the puzzle pieces are arranged, or perhaps land plant fossils on one side and sea animals on the other.

Procedure:

1. Read *If You Are a Hunter of Fossils*. This is a short book and could be enjoyed multiple times during the unit.
2. Have the students map their area of the "fossil bed" on the graph paper. Maps should indicate size of fossil or bone, shape, directions, depth. Measurements should be taken from the sides as well as from the top surface. Students should record a grid number based on the lay out of the original bed so the maps can be put back together.
3. Students begin to remove fossils with the tools of a paleontologist. Using picks and paint brushes students remove fossils without breaking them. Once fossils are removed, discard the "matrix" and clean the area. Additional newspaper under their work space is helpful.
4. Have students write an interpretation of their find. What do they think they have? Many books are available if real fossils are to be identified. Is it plant or animal? Land or sea? What evidence do they have to back up their inferences?
5. Assemble the grid maps on a bulletin board or chalkboard. Each group tells about their find. Now they can see the other parts and hear from other "paleontologists", what changes do they want to make in their theory? Reinforce the idea that scientists change their theories as more evidence is collected.

Assessment:

- A checklist of process skills used during the investigation is appropriate.
- A fossil bed worksheet that requires making observations and inferences could be used.
- Have students create a story or poem in the style of Byrd Baylor and illustrate it. Their writing should be based on their own feelings about collecting fossils, either in the classroom or on their own. If students have collected fossils let them share their experiences prior to writing.

Further Challenges:

- Make a time line that shows when the "real" fossils you have used were living. Based on the geological changes that have occurred, when would the "fossil bed" dug in class fit in?
- Find fossils in building materials in your area. They may be inside as part of counter tops, floors, walls, lamps or coffee tables; or outside as building stone, limestone is a popular material and many fossil pieces can be found in them.

Resources/References:

Children's Books

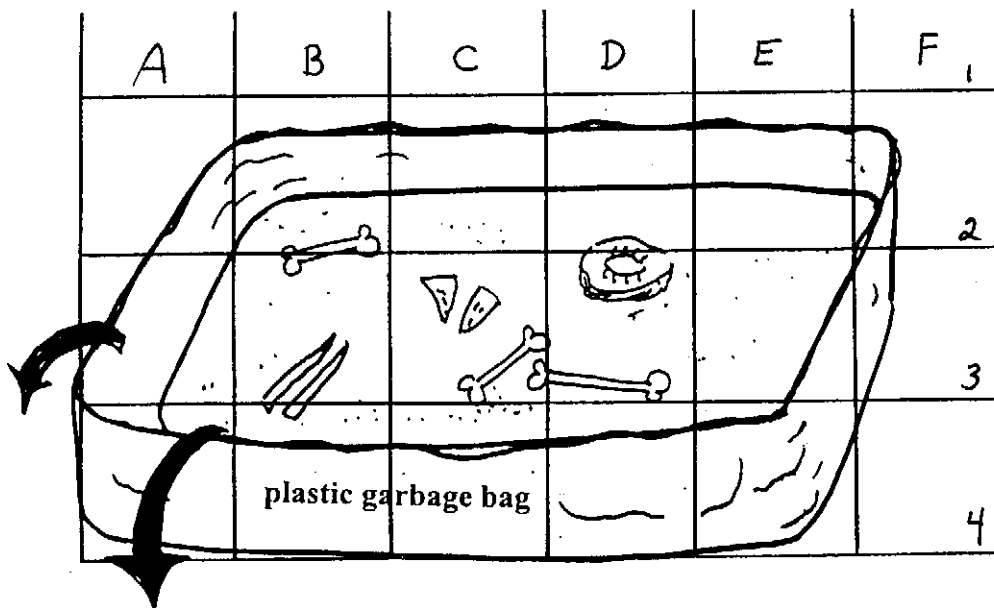
Aliki. (1972). *Fossils Tell of Long Ago*. Harper Trophy
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Teacher's Books

Grant, L. (1991). *Discovering Bones*. The Royal Ontario Museum, New York: Addison-Wesley Publishing Co.
Niles, G. & Eldredge, D. (1989). *The Fossil Factory*. New York: Addison-Wesley Publishing Co.

The Author:

Carol Van De Walle, Audubon Math/Science Elementary School, Rock Island, Illinois.



Pull bag over books/magazines and tape to make pool.

Van DeWalle

Artifact or Fiction? The Changeable Nature of Scientific Knowledge

by James D. Laney, Ed.D.

Materials and Equipment:

- a suitcase
- various items to "pack" in the suitcase (e.g., items that suggest the owner's physical characteristics and personality; items associated with the owner's interests, hobbies, and skills; items identified with the owner's personal, educational, and professional background.)
- tissue paper

Literature:

Digging to the Past by W. John Hackwell

Focus:

The objectives of this lesson are for students to be able to:

- understand how a model can be used to further our understanding of a process
- make accurate observations about artifacts,
- make reasonable inferences based on observations,
- revise inferences based on "new" information,
- describe the work/skills of an archaeologist,
- describe how scientific "facts" are sometimes subject to change, and
- use their creative thinking skills to imagine what future archaeologists might infer about "artifacts" from the present day.

Challenges:

How do archaeologists retrace the lives and customs of people who lived in the distant past, especially in the absence of written records/primary sources of information?

How/why does scientific knowledge about past cultures change?

Advance Preparation:

Borrow the items to be packed in the suitcase from an adult whom the students know. Select items that have potential for revealing something about the owner's characteristics and/or background.

Pack these items in the suitcase, grouping like items (e.g., jewelry, clothing) together and separating each set of items from the next set with a layer of tissue paper. The layers of tissue paper are analogous to layers of soil in an archaeological dig.

Plan for two or three sets of items (or layers of artifacts), with each set of items consisting of at least one item for every four students in your classroom.

Prepare a handout entitled "Data Summary Table" and reproduce one copy for every four students. The blank table should consist of three columns labeled "Object", "Observations", and "Inferences".

Draw a cross-sectional outline of the suitcase on the chalkboard. (Imagine you are viewing the suitcase from the side where the handle is located.)

Procedure:

1. Before initiating the "suitcase dig" activity described below, read W. John Hackwell's *Digging to the Past* to your class. Have the class identify and discuss the various tasks/jobs (e.g., excavator, cataloger, field laboratory technician) done by archaeologists during a dig. Use this discussion as a springboard for organizing students into cooperative learning groups and assigning roles.

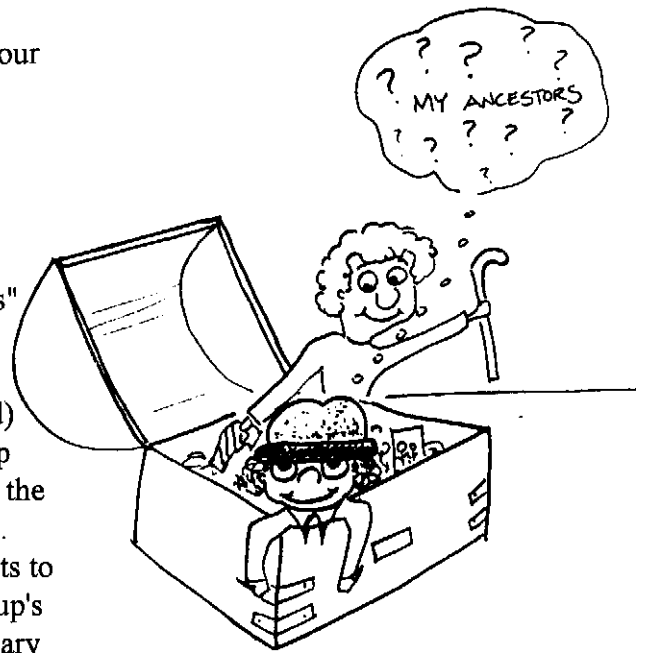
2. Divide students into "field laboratory technician teams" (i.e. cooperative learning groups of four students each). Assign each member of the team a role as follows: (a) discussion leader, (b) artifact handler, (c) recorder, and (d) spokesperson. The role of the discussion leader is to keep the group members on task as they analyze artifacts from the suitcase and discuss possible observations and inferences. The artifact handler is responsible for transporting artifacts to and from his/her group. The recorder transcribes the group's agreed-upon observations and inferences on a data summary table, and the reporter orally shares his/her group's observations and inferences with the rest of the class.

3. Tell students that human history can be divided into two time periods--prehistory and history. Prehistory, a period of approximately one million years, was before the invention of writing, while history, a period of approximately five thousand years, spans human existence from the invention of writing to the present.

Ask students how scientists are able to tell us how people lived in the distant past, when these scientists may have no (or limited) written records from which to draw information. Lead students to understand (a) that scientists (archaeologists) learn about past cultures by examining objects (artifacts) from those cultures, (b) that scientists dig (excavate) into the earth to locate these objects, which have become buried under layers of soil with the passage of time, and (c) that the oldest objects are in the deepest layers.

Reveal the packed suitcase. Tell the students that they are going to act as archaeologists trying to find out what the person is/was like who packed the suitcase.

4. Conduct a "suitcase dig" according to the following procedural steps:



Students take turns "excavating" the suitcase by removing one "artifact" at a time. Stop the excavation when all items from the first layer have been removed.

Students also take turns as the "cataloger", drawing and labeling a simple picture of each artifact as part of a cross-sectional diagram of the suitcase and its contents. This diagram, drawn on the chalkboard, serves as record of each artifact's original location within the suitcase. Be sure that the cataloger draws a line to represent the tissue paper which lies beneath the first set of artifacts and separates the first and second sets of artifacts.

Distribute the artifacts from the first layer—one artifact to each "artifact handler". The artifact handlers convey these artifacts, along with a "Data Summary Table" handout, to their respective "field laboratory technician teams" for analysis.

Q What stories do artifacts tell us?

Ask each team to analyze its assigned artifact as follows:

- Make accurate observations about the artifact.
- Record observations on your data summary table.
- Based on your observations, make reasonable inferences about the person who packed the suitcase. These inferences might deal with his/her gender, age, physical characteristics, personality characteristics, education, interests/hobbies, organizational memberships, honors, religion, place of residence, etc.
- Record inferences on your data summary table.

Have the "spokespersons" share the observations and inferences from their respective groups with the rest of the class.

Repeat steps 1-5 above with each successive set/layer of artifacts.

5. Lead a whole-class discussion. Ask:

- Which set/layer of artifacts was packed first? Last? How do you know?
- Are your team's inferences consistent with each other? With those of other teams?
- Do any of your early inferences need to be revised/changed in light of artifacts you examined later on?
- Are there any inferences about which you feel very confident? Which ones? Why?

6. Point out that even the inferences an archaeologist feels confident about may later be rejected as (a) additional artifacts and/or written records are discovered and analyzed and (b) new technologies and methods of artifact analysis are developed.

7. Test the accuracy of the students' inferences by inviting the owner of the suitcase and its contents to tell about each artifact. Point out that a real-life archaeologist cannot test his/her inferences in this way.

8. Through generating a semantic web or summary paragraph, have each student tell what s/he learned about (a) the work/skills of an archaeologist and (b) the changeable nature of scientific knowledge.

9. Have each student choose an object from the present day. Then ask students to pretend they are archaeologists in the year 4022 and brainstorm creative (and perhaps unreasonable) inferences about their respective objects and the people who used them. Challenge students to create a museum exhibit of these "artifacts", with each artifact accompanied by a written description of current "scientific knowledge" relating to that artifact.

Q What will our trash tell future archeologists?

Assessments:

- Assess the accuracy of students' observations and reasonableness of students' inferences by examining each group's "Data Summary Table" from the "suitcase dig" activity.
- Students' creative thinking will be assessed through the products generated in the "museum exhibit" challenge.
- The semantic webs or summary paragraphs described above will be evaluated, using completeness and accuracy of information as evaluation criteria.
- Documentation of each student's learning may be placed in his/her personal portfolio.

Further Challenges:

- Have your class create a time capsule to be discovered by future archaeologists. Select items for inclusion in the time capsule that would allow future archaeologists to infer something important about the culture of your classroom or school.
- Read pp. 1-20 of David Macaulay's *Motel of the Mysteries* to the students and show the accompanying illustrations. Macaulay's work is actually a humorous picture book written with an adult audience in mind, but it is also appropriate for use with upper elementary children as a tool for initiating creative thinking. Pages 1-20 describe some of the discoveries and erroneous inferences made by archaeologists in the year 4022 about life in the ancient country of "Usa" (U.S.A.).

- Ask the students:
 - Are these inferences accurate? Why? How do you know?
 - Do you think these inferences are reasonable in light of the observations upon which they are based?
 - The author makes fun of scientific knowledge. What message is the author trying to convey to his reader? (Scientific knowledge is changeable/uncertain. In applying the scientific method, inferences/hypotheses are sustained/rejected but not proved/disproved.)
- Show students the illustrations of pottery designs in Byrd Baylor's *When Clay Sings*. Ask students to: (a) make observations about these designs, and (b) make inferences about the daily life and customs of the people (i.e. the prehistoric American Southwest Indian tribes) who created these designs. Then read the book to your students, and have students compare and contrast their inferences with those of real-life archaeologists.

Resources/References:

- Baylor, B. (1972). *When Clay Sings*. New York: Scribner.
- Hackwell, W. J. (1986). *Digging to the Past*. New York: Charles Scribner's Sons.
- Laney, J.D., & Moseley, P.A. (1990). Who packed the suitcase?: Playing the role of an archaeologist/anthropologist. *Social Studies and the Young Learner*, 2(3), 17-19.
- Macaulay, D. (1979). *Motel of the Mysteries*. Boston: Houghton Mifflin Company.

The Author:

James D. Laney, Ed.D. is an Associate Professor with the Department of Teacher Education and Administration at the University of North Texas, Denton.

Mesozoic Manor

by Dr. Jan Woerner

25

Literature:

The Dinosaur Who Lived in my Backyard by B.G. Hennessy

Focus:

To help children develop the idea that things in the real world are connected, educators can design their units and lessons around one of several integrated models (Fogarty, 1991). These particular lessons, and the unit from which they come, is conceived as a wholly integrated unit with the concepts to be taught in all disciplines overlapping throughout an inquiry about dinosaurs.

While most children are enthralled with dinosaurs, it is a difficult topic to approach in a constructivist manner. Children often memorize many unconnected facts about dinosaurs, but the inability to achieve a true first hand experience (directly observable and occurring in real-life settings) limits the degree to which concepts can be actively constructed by children.

In these lessons, students are exploring the following science concepts:

- Living things have characteristics by which they can be distinguished.
- Animals have particular characteristics that help them to survive in their habitats.
- Plants and animals are specific to different habitats.
- We have found fossil evidence of plants and animals that lived in habitats of long ago.
- As climates changed through time, the variety of life has changed accordingly.

In addition, students will be focusing on the following:

Language Arts goals:

- listening and responding to a variety of literary genre;
- using the writing process in response to literature and to help communicate ideas
- using organizational skills
- recognizing synonyms, antonyms, homophones, etc.

Social Studies goal:

- developing a historical and geographical understanding of the Earth

Materials and Equipment

- string, stakes, chalk, or other materials used to mark off areas on the playground or gym floor.
- meter sticks, rulers, tape measures
- xeroxed dinosaur outlines, many different dinosaurs should be used
- brads, scissors, hole punchers, paper for science journals
- cardboard boxes, construction paper, clay, and other materials for dioramas and scale models of dinosaurs
- as many kinds of second hand evidence for students, including models, pictures, wooden skeletons, and other visuals of dinosaurs and their habitats
- computers, computer software, laser disks, and CD-ROM disks on dinosaurs
- audio and video tapes about dinosaurs
- center with many books and magazines on dinosaurs

Mathematics goals:

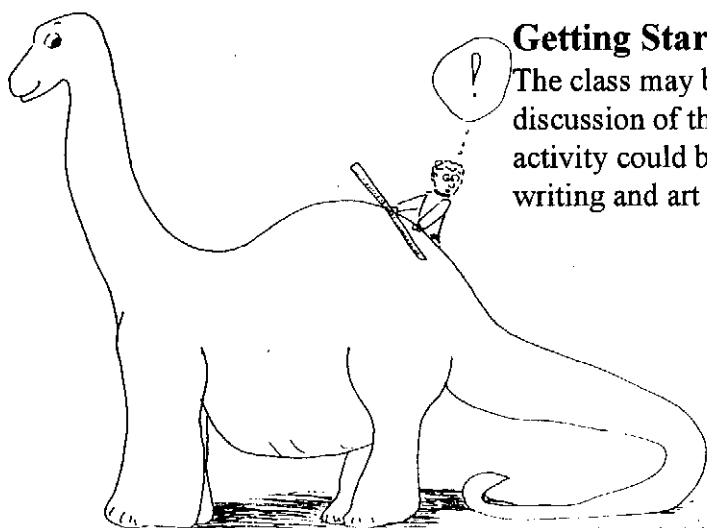
- estimating the sizes of animals, buildings, and land areas using literature, pictures, and logical problem solving methods;
- using standard and non-standard units of measurement to find out how big dinosaurs might have been;
- making sketches to scale, showing their work.
- In addition, tapes with dinosaur songs can be used within these lessons, and the students can imitate dinosaurs walking or running. Students can use various visual art techniques and skills to produce two and three-dimensional projects.

Challenges:

- What kinds of plants and animals lived on the Earth long ago?
- How can we find out about organisms that lived long ago?
- What features characterized the dinosaurs?
- What kinds of plants and animals lived at the time the dinosaurs lived?
- What was the climate like in the Mesozoic?

Getting Started:

The class may be in a whole class format for reading and for discussion of the various projects. The outdoor measuring activity could be done as a whole class project. Indoor writing and art projects may be completed by groups of two or four, or could be done individually. The unit should be introduced by establishing a center on dinosaurs and other living things of the past. This center should have lots of room and have bulletin board or wall space for a time line and for a dinosaur family tree. This center can be added to by contributions from students as you prepare the unit activities.

**Activity 1: A Dinosaur in my Backyard****Procedure:**

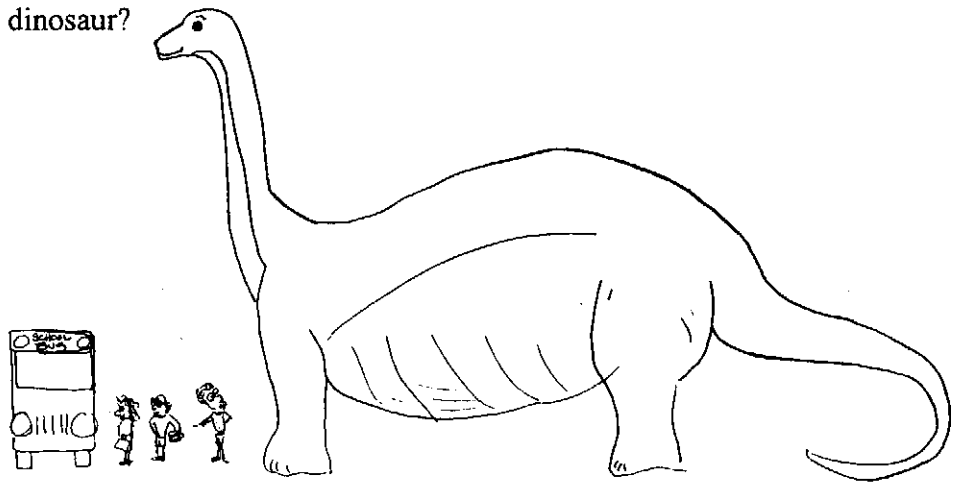
1. Engage the students in the topic by reading *The Dinosaur Who Lived in my Backyard*. When you have finished the story, ask the students, "How big is the dinosaur in this story?" and "How big is your backyard?" "Could a dinosaur live in your backyard?"
2. Develop an average backyard from the student responses. Help the students use several different ideas to come to an average size for a backyard. Ask students how we could

figure out how big this backyard was. "Can you run around in your backyard? How many steps does that take?" "What plants or animals live in your backyard?" "Are there buildings or play equipment?" Drawing the backyard on a piece of butcher paper and write the suggested measurements on your "scale" model.

3. The students can measure their pace in order to use it outdoors. Mark off a length such as 10 meters (or less) and have the students count how many whole paces it takes to go that distance. Using calculators, divide the distance by the number of whole steps, and you will have the length of one pace. Using a calculator, divide the length of the "backyard" by the pace length, and the student will know how many whole steps to take to walk the length of the backyard. Do the same for the width. Have students record this so they can use it for other activities.

Q Are all "paces" equal?

4. "How big is a school bus?" If one is available, measure it with a tape measure, rulers, string, or paces. If none are available, have the students create a simulated bus. "How many students fit on a bus?" Arrange chairs to resemble the seats on a bus. Measure with rulers or tape measures. Draw the bus on the piece of butcher paper to the same scale as the backyard. Label its length, width and height. How much bigger than the bus is the dinosaur?



5. "How big is the dinosaur in the story?" Look at the picture of the dinosaur, house, and school bus. Make a drawing of the dinosaur with measurements on your butcher paper. Go outside on the playground (or use the multi-purpose room or gym) with your butcher paper drawings, string, stakes, chalk, paper, rulers, tape measures, etc. Mark off the "backyard" so you can see how big it really is. You can use student paces or whole students as measuring devices, also. How big is the dinosaur? If your building is more than one story tall, you may be able to estimate where on the building the top of the dinosaur would be. If not, lay

Q How many dinosaurs would fit in a backyard?

out the dinosaur on the playground or gym floor in two dimensions, using chalk or string and stakes to mark the outline. "Will the dinosaur fit in the backyard?" Use paces, number of students who could fit in the backyard, rulers, tape measures or other methods to solve this problem.

6. Go back inside and have students explain whether the dinosaur could fit in the yard or not. Have students select a construction paper dinosaur to use as a cover for a journal. Have them make sketches of what they did outside and explain whether the dinosaur would fit in the backyard. Tack your butcher paper to the bulletin board in case they need a reference. After they are finished, have the students explain what they have written and how they solved the problem.

7. Were the other dinosaurs in that book as big as the one we did out on the playground? Estimate how much bigger or smaller they were. Would any of them fit in our backyard?

Activity 2: What Did Dinosaurs Look Like?

Procedure:

1. Read *The Biggest Dinosaurs* to the class.
2. After reading, ask the students, "What did dinosaurs look like? What characteristics did they have?" Make a list of characteristics for dinosaurs. Did all dinosaurs have each of the characteristics on the list? Choose 8 or 10 possible characteristics, and have the students make a chart on one of the pages of their journals. Each student should pick a different dinosaur and describe it using the 8 or 10 characteristics decided by the class. Some possible categories they might choose are:

NAME	HORNS?
PRONUNCIATION	CLAWS?
NICKNAME	FEET USED?
FOOD	ARMORED?
HABITAT	LOCATION

3. Once students have the information, they will construct a "scale" model of the dinosaur in its habitat. This can be done individually or in groups of two, three, or four. Students should build a three-dimensional diorama, showing other living things that would have been around. Was the area a desert, a swamp, a sea, a mountain? While working on the diorama, students can enter their data on a computer, creating a class database on dinosaurs. AppleWorks, Claris Works, Bank Street School Filer, or other database can be used.

4. Have the students demonstrate their dioramas to others in the class. They should record this information in their journals, also. What further information do they need about this dinosaur? Read *The Day of the Dinosaur* to wrap up what they know. Students can add any new information to the computer database.

Assessments:

- Students can be assessed on the shape, scale, size, and habitat shown in their diorama and on the concepts recorded in their journals. Students could be assessed on cooperation, group work, and contributions to the outdoor project.
- Cinquains, diamantes, or haikus could be introduced and students could write poems about their dinosaurs, identifying the major features. Haikus and diamantes could also be used to describe what life was like in the Mesozoic.
- A "Who Am I?" or "Twenty Questions" game could be used for assessment, with student writing the clues from their journals.

Activity 3: Classifying Gummi Dinosaurs

Procedure:

1. Begin the next lesson with the characteristics that distinguished dinosaurs from other living things. This lesson could begin with the book *My Visit to the Dinosaurs*. Students can begin to distinguish between different types of dinosaurs and other things that lived during the Mesozoic. The book *Strange Creatures that Really Lived* would broaden the discussion, as would *If You Are A Hunter of Fossils*.

2. Give groups of students a bag of gummi dinosaurs (they come both with and without sugar). Let the students classify the dinosaurs based on the characteristic they can see. Instruct the groups to keep track of their dinosaur groups, and the characteristics they used to sort them.

3. Observe and discuss the gummi dinosaurs.
- How are the dinosaurs alike?
 - How are they different?
 - What would you name the different groups of dinosaurs?
 - Are all members of your sample dinosaurs? Why or why not!

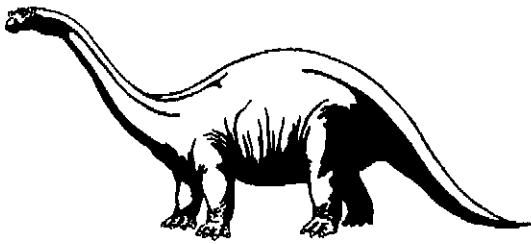
Materials and Equipment:

- 1.5 pounds of gummi dinosaurs
- 8 plastic bags

- How are the dinosaurs alike?
- How are they different?
- What would you name the different groups of dinosaurs?
- Are all members of your sample dinosaurs? Why or why not!

Materials and Equipment:

- Plaster of Paris
- PAM or other non-stick cooking spray
- paper cups
- hammer
- sea shells
- wooden stirrer
- water

**Activity 4: What do Fossils Look Like?****Procedure:**

1. Read *If You Are A Hunter of Fossils*.
2. For the exploration, provide students with many different kinds of fossils and have them classify them. Students can infer whether they were plants or animals.
3. After they have observed real fossils, they could make fossils in Plaster of Paris. Obtain two or three shells from ocean animals, a paper drinking cup, and a wooden stirrer. Spray your shells with PAM or other non-stick kitchen spray. The teacher will prepare Plaster of Paris by mixing the dry powder in a large pan with enough water to make a thick slurry (like thick oatmeal). Each student will fill their paper cup 1/2 full of the liquid and place the shells on the surface of the plaster. Pour more plaster over the shells until they are covered. Let the cup sit for several hours.

After the plaster is dry, remove the plaster from the cup and tap slightly on the side with a hammer. The plaster should break around the shell, showing a cast of the shell in the plaster.

How is this fossil similar to or different from fossil dinosaurs? Is it like the fossils we classified before?

4. The book *Dragon in the Rocks* should be read as a follow-up to this lesson. This book is about a real girl who collected fossils.

Further Challenges:

- You also could create a dinosaur footprint puzzle as a problem for students to interpret.
- Plastic skeletons can be obtained from biological supply companies, and the skeleton can be put together like a dinosaur skeleton would be put together in a museum. At least two supply companies are selling a "Dinosaur Dig" kit with a simulated scale dinosaur skeleton that the student digs out and puts together.
- Students could use video tapes on dinosaurs to get a better idea of what the land was like in the Mesozoic. Maps could be made of where different kinds of dinosaurs had been found.
- After many dinosaurs have been discussed, several dinosaur names should be put up on the board, and what the nickname is put beside it. Students could then develop the idea of the meanings of the prefixes, roots, and suffixes, and mix and match, making up new dinosaur

names. Names can be connected to the real characteristics of the dinosaurs.

- Why did dinosaurs become extinct? Isaac Asimov's *Did Comets Kill the Dinosaurs* could be a beginning to an exploration of this question.
- Use audio tapes with dinosaur songs to encourage students to think about sounds dinosaurs might have made. Several different albums include dinosaur "dances" where children are encouraged to walk and move like dinosaurs.

Resources/References:

Children's Books:

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- Asimov, I. (1988). *Did Comets Kill the Dinosaurs?* Milwaukee, WI: Gareth Stevens Publishing.
- Baylor, B. (1980). *If You Are A Hunter of Fossils*. New York: Charles Scribner's Sons.
- Berenstain, Michael. (1989). *The Biggest Dinosaurs*. New York: A Golden Book and Racine, WI: Western Publishing Company, Inc.
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- Day, M. (1991). *Dragon in the Rocks*. Toronto, Canada: Greey de Pencier Books.
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- Stout, W. (1981). *The Dinosaurs*. New York: Bantam Books.

Teachers' Book:

- Fogarty, R. (1991). Ten ways to integrate curriculum. *Educational Leadership*, 49(2), 61-65.

The Author

Jan Woerner, Ed.D, Associate Professor of Education. Elementary and Bilingual Education Department. California State University, San Bernardino.

Materials and Equipment:

- tag board
- paper or plastic cups
- paper plates
- pictures of many types of bats especially those displaying ears/nose leaves that are used in echolocation
- scissors
- markers or crayons
- brown or black cloth or fake fur (optional)
- stapler



Literature:

Taking Katy for a Nightride by E. Menzies

Focus:

Nearly 70% of all 1000 species of bats in the world use echolocation. Researchers have learned that bats can tell the distance of an object by the time lapsed between making the sound and receiving the incoming echo. Processing information from returning echoes involves a biotechnical marvel—the bat's brain. Hundreds of thousands of dollars are spent every year to study echolocation in bats for use by the medical profession, the U. S. military and other scientific groups.

By using echolocation, a system that uses high-frequency sound waves well above the range of human hearing, small insect-eating bats can follow and catch prey in total darkness. They "scan" for insects by sending out as many as 500 pulses per second. This system is so precise that a mosquito can be detected as well as some objects no wider than a human hair. Not all bats use this technique. (For instance, fruit bats don't need it because they don't hunt moving prey). Special grooves inside the bat's ears help to channel the sounds into the ear.

Various species of insectivorous bats, especially those in the tropics, are equipped with special appendages called "nose-leaves" which are thought to help make and project sounds for echolocation. These structures show enormous variation, ranging from spear-shapes to triangular to intricate systems of wrinkles and folds. The shape and position of the nose-leaf affects the pattern of sound radiation from the bat. Most bats we are familiar with living in the temperate zone have plain faces.

Here are some activities to acquaint students with the wide variety of bats in the world. They will become knowledgeable about the marvelous ability a bat has to use echolocation for navigational and food hunting purposes. Students will also better understand the science of sound and echoes.

Activity 1: Batty Ears

Challenge:

How are the ears and noses of bats similar and how are they different?

Procedure:

1. Using the various materials provided (tag board, paper or plastic cups, paper plates, etc.) ask the students to devise some ears that will enhance their hearing. They will probably end up with funnel shapes and other "sound catchers" that work quite well.
2. Display pictures of a wide variety of bats. Have the students describe how the ears of the bats are similar and how they differ. Ask if any of these bats have ears that are like the devices they designed earlier. Discuss how the bats' ears and nose-leaves (if they have them) help bats send out and receive echoes to hunt food and to navigate in the dark.
3. Ask each student to select his/her favorite bat. Give out construction paper, scissors, crayons or markers. Using the materials have the students construct ears similar to those of their favorite bat. Grooves and other special features should be drawn on the ears to make them authentic. Cloth or fur may be glued or stapled onto the ears. (Young children may need a pattern.) The ears may be attached to a headband with a stapler. The student-made ears will differ just as ears of many special bats differ.

Activity 2: Oh, What a Spectacular Nose!

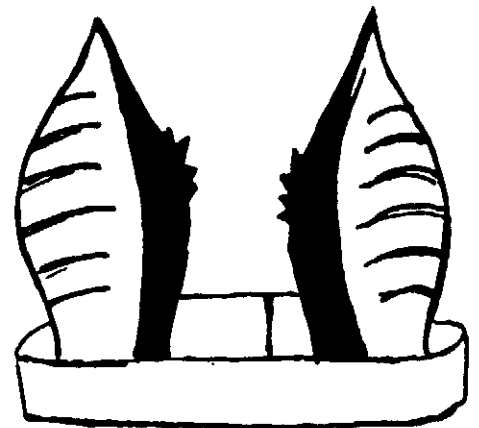
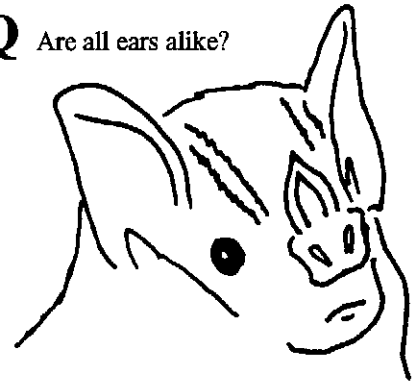
Challenge:

Where are the bats that have nose-leaves located? How does a bat use its nose-leaf?

Procedure:

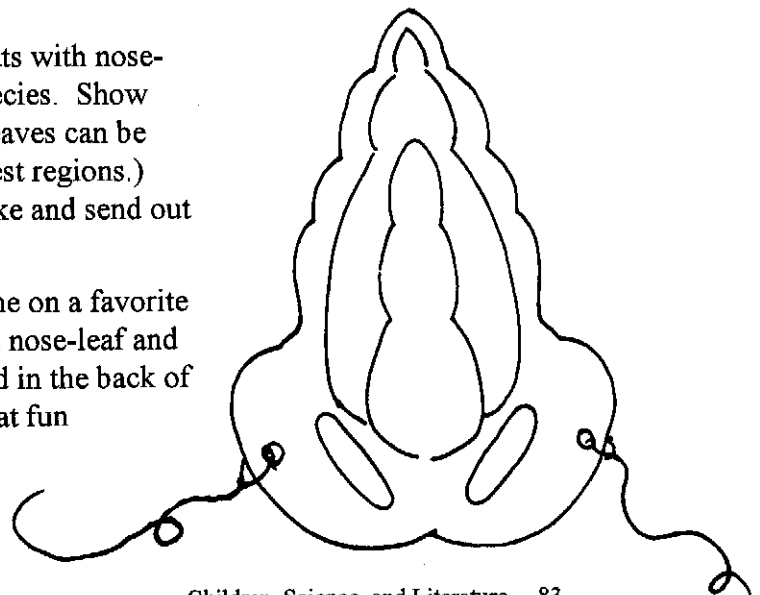
1. Make sure you have included pictures of bats with nose-leaves in your bulletin board display of bat species. Show area on the world map where bats with nose-leaves can be found (in tropical zones, especially in rainforest regions.) Discuss how the nose-leaf enables a bat to make and send out echolocation sonar.
2. The children may design a nose-leaf like one on a favorite bat. Punch holes in the sides of the completed nose-leaf and attach string or elastic thread which can be tied in the back of the student's head. The students will have great fun modeling their bat nose-leaves and ears.

Q Are all ears alike?



Materials and Equipment:

- world map
- construction paper
- markers or crayons
- scissors
- string or elastic thread



Activity 3: Bat Sound Bounce Back

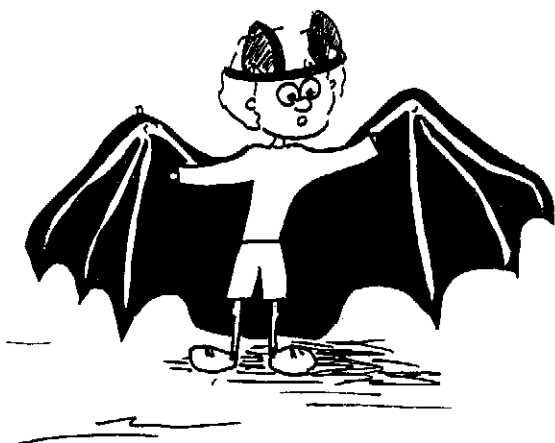
Challenge:

How do bats distinguish between sounds that are made by echolocation?

Materials and Equipment

- blocks of wood
- pictures of insects which are eaten by a bat
- several small surfaces on which the pictures can be mounted
- small ball

Q Do some walls produce better echoes than others?



Procedure:

1. Provide the students with some experiences with echoes. For example, slap two blocks of wood together and listen for the echo bouncing back from a wall. Or allow individuals to shout at a wall outside to hear the echo.

2. Locate pictures of insects which might be eaten at night by bats; mosquitoes, beetles, moths, mayflies, etc. Tape each picture to a different small surface such as card board, styrofoam tray, thick cloth, corrugated cardboard, etc. Then attach each of these pictures and their backing to a bulletin board. When you are setting this up check to make sure a different sound can be distinguished when a ball is thrown against each insect. While the students are carefully listening, bounce a ball against each insect. Have them listen to the sound made by each surface. When the students have memorized how each insect surface sounds when the ball hits it, they are ready to play the game.

3. One student turns his/her back to the bulletin board where the insect pictures have been posted. A second student bounces a ball against an insect. By listening to the sound, the first student must identify which insect was hit. The activity is repeated with the ball being bounced from a different insect each time. The students keep a tally of the correct responses out of ten tries.

4. After several students have had the opportunity to try out their 'echolocation', discuss how the recognition of sounds in this activity is similar and different to the way a bat locates food.

Activity 4: Graph A Bat

Challenge:

What is the difference in size between the smallest bat in the world and the largest one?

Procedure:

1. The smallest bat in the world is a Kittie's hog-nosed bat of Thailand which is the size of a bumble bee while the largest is a flying fox bat from Australia which has a wing spread of 1.8 meters (six feet). Have the students copy a flying fox bat on graph paper from the numbered depiction of the bat given them (see example). This bat is not a fox at all - but is a

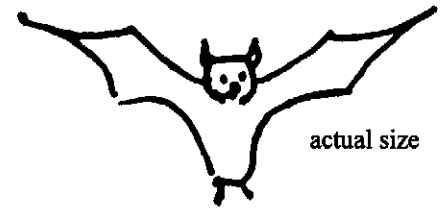
Materials and Equipment

- graph paper for each student
- masking tape
- chalk
- brown and black tempera paint

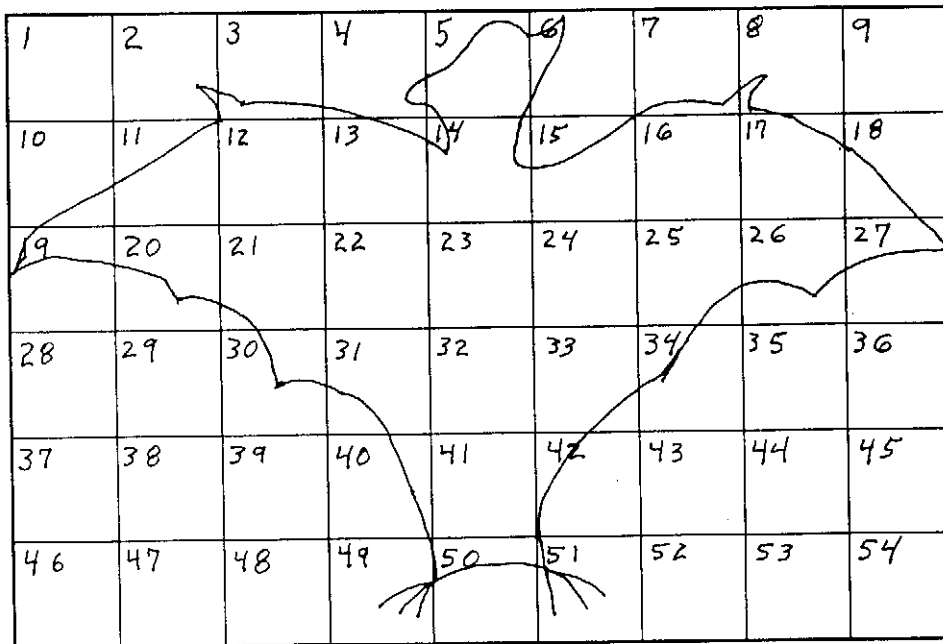
Q How large is the largest bumble bee?

member of the bat family. Enlarge the bat grid on a piece of larger graph paper. Finally, let students create a giant life-sized bat on the playground from the grid.

2. With masking tape, place a grid of 20-cm squares on the asphalt or concrete playground. Referring to the paper grid as a guide, have the students count the number of turns that can be taken to complete the drawing if one student is assigned to each square. Then, one at a time, the students can mark the bat's outline in chalk. Paint the chalk lines with black tempera and paint the bat's body brown. This bat will be the talk of the playground.



Kitti's Hog-nosed Bat of Thailand is the size of a bumble bee.



The largest bat is the Flying Fox Bat of Australia with a wing spread of 1.8 meters. Each square equals 2 decimeters.

Resources/References:

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Milton, J. (1993). *Bats, Creatures of the Night*. New York: Grosset & Dunlap.

Teachers' Books

Fenton, M. B. (1991). "Seeing in the Dark," *BATS*, published by Bat Conservation International, Summer. Zoo Books, *BATS*. San Diego, CA: Wildlife Education, Ltd.,.

The Author:

Judy McKee, Primary teacher, Teacher consultant, Central School, Wilmette, Illinois.

Literature:*Owls in the Family* by Farley Mowat*Uhu* by Annette Macarthur-Onslo**Focus:**

Owls--spooky, wise, silent, hooting, wide eyed, mysterious. Everyone, including your students, has a "first impression" of these "whoo-biquitous" birds. Owls and the science concepts that they illustrate can wing their way into your classroom using some trade books you perhaps already read with your students.

Owl adaptations fascinate children. Perhaps the most outstanding owl characteristic is large eyes on the front of the head. The owl's skull is broad to accommodate huge eyeballs, which are excellent light gatherers. Though owls can't see in complete darkness, their vision is very sensitive. In dim light, they can see 10-100 times better than humans.

Challenges:

Unlike human eyes, owl eyes do not move in their sockets. Owl eyes can be modeled by asking children to look through "binoculars" made from toilet paper tubes. They will note that in order to look to the left or right, they must move their heads. Owls have 14 neck bones where we have 7. They can turn their heads in almost a full circle in order to have a panoramic view. Vision with two eyes on the front of the head, binocular vision, allows the owl (and us!) to judge how far away an object is. To support this concept, ask the

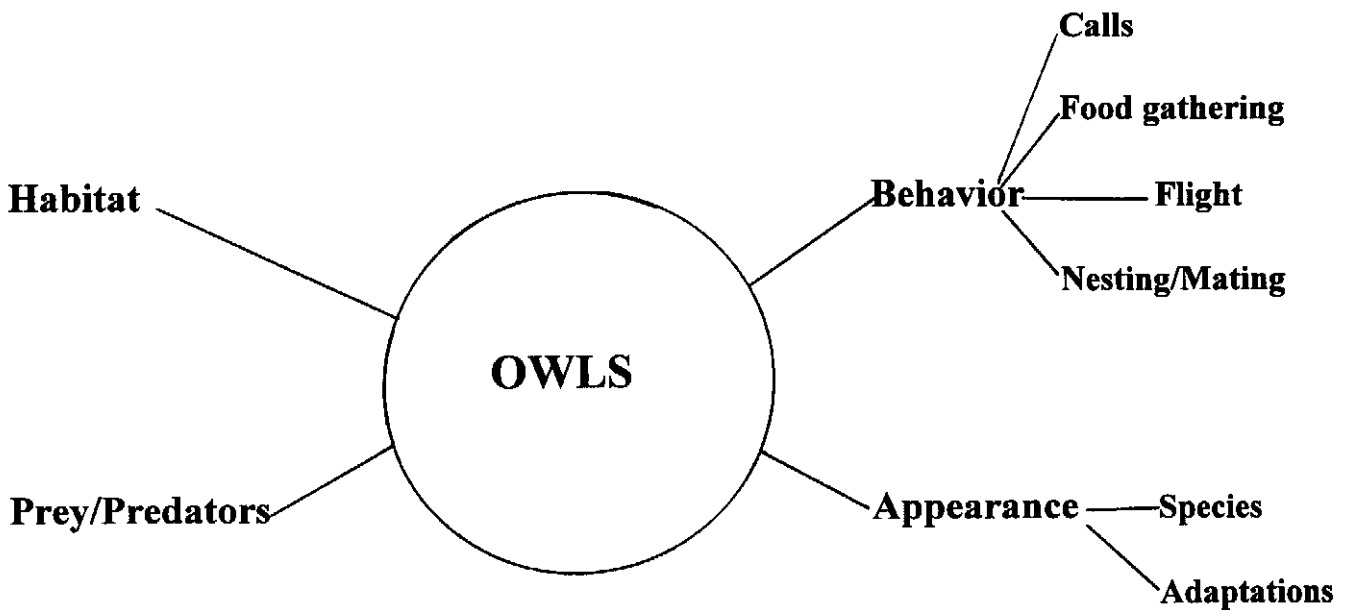
children to choose partners and play catch. First play with two eyes open then with only one eye open. It will be more difficult to estimate distance with only one eye. Why is it important for a bird of prey to have eyes in the front of its head rather than on the sides (like a chicken or robin)?

Procedure:

1. Begin by asking the children to draw an owl and then to "list everything you know about owls" as pre-assessment tasks.
2. As the owl unit develops, ask students to arrange information from fiction and non-fiction reading in the form of a semantic map. This can also be presented in pictorial



form. See the diagram at the top of the page. Find descriptions of owls in the readings and ask "What makes a bird an owl?" Try to connect these features with the way the owl makes its living--as a night hunter.



Semantic Map

3. Trade books such as *Owls in the Family* and *Uhu* can provide a framework for a study of owls. While students are reading these, they can consult non-fiction tradebooks and library reference material as well. Additional information for the semantic map can be obtained through videos and a live owl presentation by a wildlife rehabilitator. The rehabilitator may bring an injured bird that cannot be released. This would be a good time to remind the children that keeping wild animals as pets is generally not good for the animals and is illegal in some cases. The children in *Owls in the Family* and the author in *Uhu* each decided to keep a baby owl in captivity. With your students, weigh the benefits and disadvantages to the owl in each case.

Resources/References:

Children's Books:

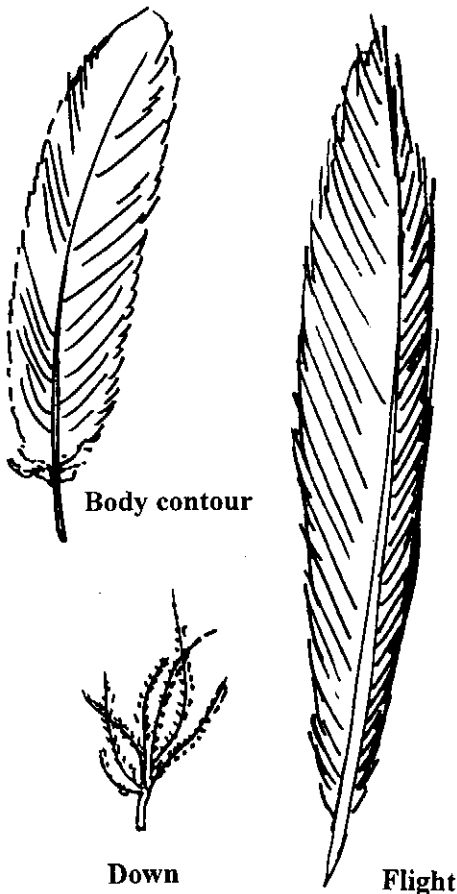
- Macarthur-Onslow (1969). *Uhu*. New York: Alfred A. Knopf.
 Mowat, F. (1985). *Owls in the Family*. New York: Bantam Books.

The Author

Fran Ludwig, is a K-5 Science Specialist for the Lexington Massachusetts Public Schools.

Materials and Equipment:

- feathers of different sizes from the same type of bird (you can obtain these from a chicken farm, old pillow or coat, or by looking near the roosting spots of non-migratory birds—you need a federal permit to collect feathers from migratory birds). You should place feathers in an old pillowcase and wash them in warm soapy water before using. Rinse them and let them dry.
- magnifying lens
- paper and pencil
- light cardboard
- scissors
- bits of velcro (the hooked part)
- a zipper

**Literature:***Bird* by David Burnie**Focus:**

Each feather on a bird has a specific job to do. By grouping feathers according to their appearance, students can interpret which part of the bird a feather is from. Owl feathers can then be compared to feathers from other birds. Feathers are made from keratin (a protein) the same materials that is in human hair, fingernails, and the scales of lizards.

Challenges:

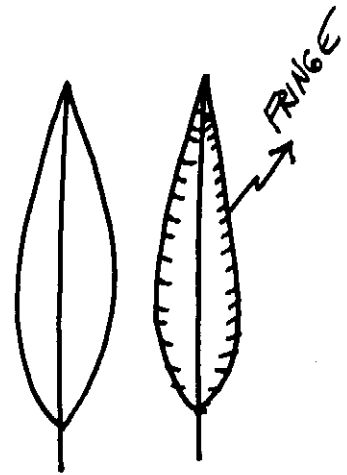
What are the parts of a feather? How do feathers vary? How can you tell which part of the bird a feather is from just by looking at it?

Procedure:

1. Look at a large feather and draw it carefully. Use a magnifier to look closely. Label the parts of the feather. (quill, shaft, barbs)
2. Run your fingers down the feather from the tip to the quill. Watch as the feather separates along its barbs. Use a magnifier to look carefully. The barbs look like tiny feathers within a feather. How are the barbs like Velcro? Smooth the barbs back together. How do they act like a zipper? Try "unzipping" and "zipping" the feathers several times. Put a few drops of water on the "zipped" feather. What happens to the water? Most birds have an oil gland at the base of their tails. Birds pull their feathers through their beaks to "zip" together all the barbs on their feathers and to spread this oil to make their feathers water proof. This is called preening. Preening makes feathers smoother. How could this help a bird to fly better?
3. Sort a collection of feathers from the same bird into 3 groups. Label the very fluffy feathers "down feathers." The barbs in down feathers do not "zip" together, but stay loose to trap air, which acts as insulation for the bird. Label the stiff long feathers "wing or tail feathers." Label the smaller curved feathers with some down at the bottom, but with "zipped" barbs at the top "body contour feathers" You have grouped these feathers by texture and shape. In what other way are the feathers different? Down and body contour feathers are mostly symmetric. Many wing or tail feathers, have a shaft that is off center. The long slender wing or tail

feathers with the shaft closer to one edge of the feather are called flight feathers. Their shape helps the bird to fly. By looking at the feather you can tell which wing or side of the tail it came from. The narrower edge is on the front of the wing or toward the side of the tail. Line up your feathers the way you think they were on the bird.

4. Cut a flight feather shape from cardboard. Make the feather about 5 inches long. Trace another shape the same as the first and cut it out. Cut fringe all along the edge of one cardboard feather. Wave each type of paper feather near your ear. Which one makes more noise? Which type of feather do you think owls have? Explain your answer.



Assessment:

- Design a bird with paper feathers, or glue real feathers to a paper bird. Put the feathers in the correct place by looking at the shape and texture of the feathers.

Further Challenge:

- The facial discs of feathers surrounding the owl's eyes have an interesting function. They act to funnel sound into the large ear openings. Owls hunt as much by sound as by sight. Ask your students to try the effect of an ear funnel. Have them roll some paper into a shallow funnel and hold it up to an ear. Remove the funnel and note the difference in sound quality. The funnel collects sound and makes it seem louder.

Resource/Reference:

Children's Book:

Burnie, D. (1988). *Bird* (Eyewitness Book). New York: Alfred A Knopf.

Teachers' Book:

Patent, D. H. (1992). *Feathers*. Dutton, New York, New York.

The Author

Fran Ludwig, is a K-5 Science Specialist for the Lexington Massachusetts Public Schools.

Materials and Equipment:
(per student group)

- 1 owl pellet (see address with diagram)
- 1 large paper clip
- warm water (optional)
- glue
- cardboard
- magnifier
- soft small watercolor brush
- plastic bags or disposable gloves (optional)
- sensitive scale or balance


Literature:

Owls by Timothy Biel

Focus:

Owls are hunters. Students become research scientists as they interpret the remains of an owl's meal. Owls, like all birds, have no teeth. An owl swallows its food whole. After a dinner of a mouse or other animal, stomach acids digest all but the fur, feathers and bones of the prey. Digestive juices destroy disease-causing organisms. One or two times a day, an owl coughs up a pellet containing the undigested matter. By taking apart pellets you can find out about what kind and how many prey an owl has eaten. It is best, however, to obtain owl pellets from a supplier, where they are professionally sterilized, so you can reassure students that they can be handled safely.

Challenge:

How can you tell what an owl eats?

Procedure:

1. Remind students that owl pellets have not traveled all the way through the bird; they are not droppings. Some students may begin with "yuchs" but before long, they will be fascinated by the delicate bones and other clues that emerge.
2. Have students weigh the pellet. Ask students to open the paper clip half way to make a dissection tool. If you wish, you may soak the pellets in warm water before using. This helps to keep the hair and dust down. Be sure to check on allergies before starting.
3. Students may wear gloves or plastic bags on their hands initially, but most get so involved they soon work barehanded. Ask the children to carefully clean and save each bone or hard fragment. These can be weighed together to find out how much of the pellet was bone and how much fur or feathers.
4. Challenge students to sort the bones into groups. Ask what categories the groups decided on.
5. Ask: What parts of animals do you recognize? (Most likely you will find mouse skulls as well as leg bones and fragile rib bones.) What do you know about the owl if one pellet contains two skulls? (It has eaten two animals on the same hunting expedition).

6. Suggest that each group make a display of their findings. Some groups may want to glue the bones to cardboard to show their labeled categories. Others may wish to reconstruct the skeleton of the animal(s). Children should wash their hands with soap and water after working with the pellets.

Bone Sorting Chart			
	RODENTS	SHREWS	MOLE
Skulls			
Jaws			
Loose Teeth			
Scapular Blades			
Front Legs			
Hips			
Wing Legs			

Section
of Bone
Sorting Chart
as found in the
Classroom Owl
Pellet Kit available
from Pellets, Inc.,
PO Box 5484, Bellingham,
WA 98227-5484.

Permission granted for inclusion from Pellets Inc.

Assessment:

- Write a story about a night in the life of the owl who produced the pellet you worked on. Support the events in your story with information you obtained from the pellet.

Resources/References:

Children's Book:

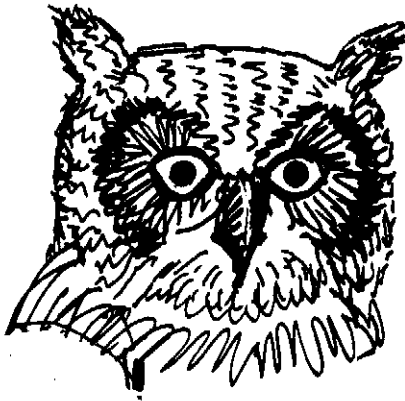
Biel, T. (1987). *Owls* (Zoobooks). Quality Publications.

The Author

Fran Ludwig, is a K-5 Science Specialist for the Lexington Massachusetts Public Schools.

Materials and Equipment:

- tape recorder and recording of owl calls
- flashlights covered by red cellophane
- binoculars (optional)

**Literature:**

The Man Who Could Call Down Owls by Eve Bunting.

Focus:

The culmination of the owl unit is an owl prowling. If you are not familiar with local owl habitat, ask an interested parent or bird club member for assistance. Find out when the breeding season is for local species. This is the time of most activity. Visit possible "prowl" locations. Look for pellets under trees. To prepare students, ask where students would look if they wanted to find an owl in your community. In the book *Owls in the Family* the boys knew that they needed to look in the woods for a nest, and that the prairie nearby was a source of mice and gophers. Owl habitat depends on the species of owls in your locality.

Procedure:

1. In class, play tapes of owl calls for your local species. Children love to imitate these sounds. Mix up the calls and see if they can identify the owl. You may wish to read *The Man Who Could Call Down Owls*.
2. As in *Owl Moon*, choose a night with a last quarter to full moon so that you won't need flashlights as much. Many children have never been out at night except at Halloween, and find a moonlight walk in the woods with a parent to be a special experience, even if no owls are to be found or heard.
3. At the site, ask the children to quietly look at the landscape. Ask: Can you see woods and a field (or whatever conditions local species require)? What time is it? Where do you think the owls are now? (hunting, or females may be on the nest)
4. Play the owl tape or try to imitate the call of local owls. Listen carefully for a reply. Be patient.
5. Look for owl clues. You may find pellets or "whitewash" (droppings) near a tree where an owl roosts while it digests a meal. If there is an owl nest, be careful to not go too close. Enjoy sharing the night with these winged hunters.

Assessments:

- Ask students to write poetry about their owl prowling.
- Ask what would happen if developers bought half of the owl habitat and turned it into house lots--or a lumber company came in and chopped down all the trees--or the

field is sprayed for weeds and the seed eating mice have poison in them.

- Present the dilemma of the spotted owl vs. the loggers. Ask the students to apply their knowledge of owls to the situation. What would they need to know about the owls to prevent them from becoming extinct?
- Classes enjoy sharing what they have discovered about these interesting birds. As a final presentation, students can share projects they have made: owl puppets and a play, a paper mache owl in a diorama showing its habitat, calendar with owl sketches and information, owl posters, owl information based games, owl poetry, or a wildlife brochure about owls.

Resources/References:

- Bailey, J. (1990). *Life Cycle of an Owl*. Bookwright Press.
- Bunting, E. (1984). *The Man Who Could Call Down Owls*. New York: Macmillan.
- Cochrane, O. (1986). *The Great Gray Owl*. (Big Book) Winnipeg, Manitoba: Whole Language Consultants.
- Garellick, M. (1975). *About Owls*. New York: Four Winds Press.
- George, J. C. (1967). *The Moon of the Owls*. New York: Thomas Y. Crowell.
- Livingston, M. (1990). *If the Owl Calls Again* (poetry). Margaret McElderry Books.
- Loates, G. (1987). *Owls*. Crabtree Publishing.
- McDonald, M. (1992). *Whoo-oo Is It?* Orchard Books.
- National Audubon Society. *Owls Up Close*.
- Selsam, M. & Hunt, J. (1986). *A First Look At Owls, Eagles and Other Hunters of the Sky*. New York: John Wiley and Sons.
- Simon, H. (1969). *Feathers Plain and Fancy*. New York: Viking Press.
- Tejima, K. (1982). *Owl Lake*. New York: Philomel
- Yolen, J. (1987). *Owl Moon*. New York: Philomel Books.



The Author

Fran Ludwig, is a K-5 Science Specialist for the Lexington Massachusetts Public Schools.

The Wonder of Whales

by Judy McKee

Materials and Equipment:

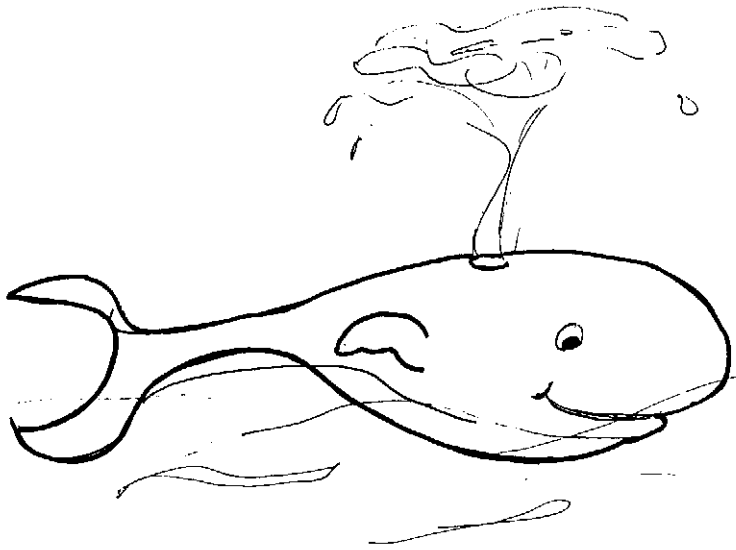
- recording of whale sounds or songs
- metal dinner forks for all

Literature:

Waiting for the Whales by Sheryl McFarlane

Focus:

Whales, or cetacea as their order of animals is called, have piqued the curiosity and imagination of people throughout the centuries. Only now are scientists beginning to really understand this mysterious creature.



Whales have no outside ear flaps as we do but their hearing is far more accurate than ours. Although whale researchers are not sure exactly how a whale hears, most feel that it hears when sound is picked up by the lower jaw and travels to the eardrum. Whales communicate with each other through a series of creaks, buzz saw sounds, clicks, motor-like noises, etc. As more research is done, it is expected that simple behavioral correlations will be discovered.

Toothed whales can navigate and locate prey by echolocation. They produce high-frequency sounds and listen for the echoes. The sounds are emitted from a fatty area called the melon in the whale's forehead.

Activity 1: Hearing without ears!

Challenge:

How do whales hear?

Procedure:

1. Listen to a recording of whale sounds or songs.
2. Have children compile a list of the kinds of sounds they hear (i.e. clicks, rattles, groans, roars, squeaks).
3. Discuss how researchers think whales hear.
4. Ask a student to strike a dinner fork against a table, then place a handle of the fork next to an ear. What is heard? A ringing or sound vibrations should be heard.
5. Next, the fork is struck again and the handle is placed between the front teeth while it is bitten rather hard. What is felt? Now the sound is a much more profound sensation as the vibrations travel through the bone to the eardrum.

Q How can a whale hear without ears?



6. Each student should repeat the experiment. Note: forks should not be shared without washing in hot, soapy water.

Activity 2: Water, Whales and Sound

Challenge:

What happens to sound when it travels in water?

Procedure:

1. Rub a rock gently with a fingernail while holding it outside the aquarium filled with water. The students should have difficulty hearing the sound.
2. The action should be repeated underwater while a student presses an ear to the side of the aquarium. Now how does it sound? The sound should be more easily heard.
3. Repeat the experience using other things such as blocks or pot lids.
4. Discuss the concept that sound travels more than four times faster in water than it does in air. This is because water, a liquid, is much more dense than air. Explain how this property of water helps whales in the ocean communicate.

Activity 3: Echo Game

Challenge:

How does a whale know the location of other things by using echolocation?

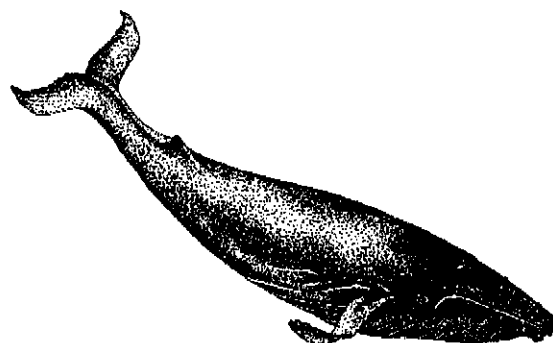
Procedure:

1. Make sure the students have had some experiences with echoes. They may shout at a wall on the playground, for instance and listen for the echo produced. Comparing the sound of echoes made in different rooms at home or school with places outside would be worthwhile.
2. The students should each be given a number. One student is blindfolded in the center while the other children scatter around the classroom, gym, or playground. The blindfolded student calls out a number and the person with that number "echoes" the number to give an "echolocation". The blindfolded student then tries to point to the echoing student. After three turns, another child should be given a chance to be in the middle.
3. Review how toothed whales use echolocation.

Materials and Equipment:

- rock
- aquarium filled with water

Q How does sound travel?



Materials and Equipment:

- blindfolds
- pieces of numbered paper

Q What is an echo?

Materials and Equipment:

- vegetable oil in one small container
- water in another
- salt

Q How does oil protect the eye of a whale?

**Materials and Equipment:**

- tub of water
- photos of whale blubber
- chicken fat or any hydrogenated fat (such as Crisco)
- oil

Q Does a slender person sink?

Materials and Equipment:

- pan of ice water
- one small zip-lock sandwich bag
- one large zip-lock bag
- shortening or lard
- thermometer

Q Why do mammals need to keep warm in cold weather?

Activity 4: Oh, those Great Big Beautiful Eyes

Challenge:

Does salt water sting the eyes of whales like it does us ?

Procedure:

1. Ask the students to recall and describe how their eyes feel when salt water from the ocean gets in them. Then ask them how they think the whale might cope with this problem. Tell them that the next activity will give them a clue as to how the whale's eyes have adapted to solve this problem.

2. Engage the students in mixing a salt solution. Give each student a turn dipping a finger into the oil and then into the salt water. Ask what happens (The oil will coat the finger so that the water will not get to it.) Then ask the students again how this could help whales. Explain that whales have a thin coating of oil over their eyes to protect them.

Activity 5: Blubbering

Challenge:

How does blubber help the buoyancy of whales ?

Procedure:

1. Ask the students to predict whether or not the chicken fat will sink or float. Then allow the students to see for themselves. Why does it do so? (It is lighter than water.)

2. Then do the same thing with the oil. Compare these to whale blubber. Discuss how blubber helps the whale to survive. Also, be sure to mention that the salt in the ocean water aids buoyancy.

Further Challenge:

Will an egg float in fresh water? Will it float in salt water?

Procedure:

Place an egg in fresh water. What happens? Add salt to the water. What happens?

Activity 6: Keeping a Whale Warm

Challenge:

How does a whale stay warm in the cold sea and in polar waters ?

Procedure:

1. Cover the small sandwich bag with a half-inch layer of shortening or lard. Then cover this with the other zip-lock bag closing it enough on each side so that the fat doesn't fall out.

2. Fill a tub with ice and cold water. Find the temperature of the water and record it. Let each student try to hold a hand in the icy water for as long as possible.

3. Discuss how difficult it is for warm blooded animals like whales to survive in cold waters especially at the poles. Ask each student to put their hand into the "blubber glove" and repeat the experience of holding it in the icy water. Discuss how the "blubber" protects their hand from the cold.

4. Place a thermometer inside the "blubber glove" to find and record the temperature. What is the difference between the two temperatures ?

5. Discuss why whales have developed blubber.

Resources/References:

Children's Books:

Berg, C. (1991). *D is for Dolphin*. Santa Fe, NM: Windom Books.

Himmelman, J. (1990). *Ibis, A True Whale Story*. New York: Scholastic Books.

Lewis, P. O. (1991). *Davy's Dream*. Hillsboro, OR: Beyond Words Publishing, Inc.

Ryder, J. (1991). *Winter Whale*. New York: Morrow Junior books.

Sheldon, D. (1990). *The Whales' Song*. New York: Dial Books.

Sis, P. (1992). *An Ocean World*. New York: Greenwillow Books.

Vollmer, D. (1988). *Joshua Disobeys*. Kansas City, MO: Landmark Editions, Inc.

Teachers' Book:

Porter, J. A. (1988). *Gentle Giants of the Sea*, The Whale Museum, P.O. Box 945, Friday Harbor, WA 98250.



The Author:

Judy McKee, Primary
Teacher/Teacher Consultant,
Central School, Wilmetre,
Illinois.

Water, It's Our Business

by Dr. Marilyn Irving

Materials and Equipment:

- pictures illustrating uses and forms of water
- maps
- globe
- water-based food or beverage mix
- ice
- double boiler
- hot plate
- beakers
- paper
- pencil
- reference books
- metric ruler
- eye droppers
- plastic wrap
- cup or covered jar
- scale for weighing food
- measuring cups
- film strips
- graph paper

Literature:

The Water's Journey by Eleanore Schmidt

Focus:

Since the origin of life on earth, living things have multiplied and spread out over the entire surface of the world. They survived under varying conditions (e.g., temperature, humidity, light, etc.). While they exist under almost all conditions, there are certain factors that must be present for life to go on. Liquid water is most important. It is necessary in some amount for every living thing on earth to have water. Water is the most abundant, unique and important resource on earth, essential for life, the only substance that occurs naturally in all three physical states (solid, liquid and gas).

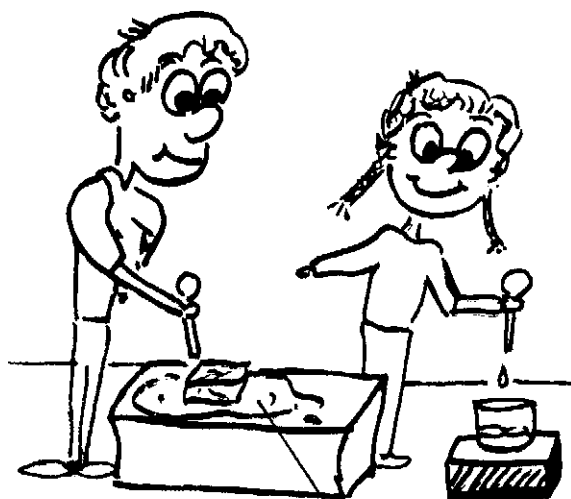
This activity is designed for students to heighten their awareness of the use and obvious effects water has on people, wildlife and the environment. Developing an appreciation for water and understanding how human activities affects its supply is the first step in the preservation and conservation of water resources for healthy viable future.

Challenges:

- Where in the world is all that water?
- What form does water take?
- How many uses can you think of for each form of water?
- How did pioneers use water?
- How does rain occur?
- Write a creative story about rain.
- Draw a picture or bring a photograph to show what each form of precipitation looks like.

Procedure:

1. Individually, in a small group, or as a class, list as many "water words" as possible. These may include forms of water, bodies of water, things you do with water, etc. Compare and display the lists.
2. Students can observe the melting of an ice cube. How big is the cube? Students can measure to the nearest cm or mm depending on their age. Record changes in the cube every 1/2 hour. Collect the melted water with a dropper. Count the number of drops of water formed from the cube. When the cube is fully melted the volume of water can be measured with a graduated cylinder. Can the water be refrozen? What will happen if the water sits out for several days? Try it and



Melting ice cube

measure the volume each day. As the cube melts discuss the three states of matter.

3. Students can observe how rain is formed. Set up a water cycle. It can be as simple as a cup covered with plastic wrap or a covered jar of water. It could be as complex as a closed terrarium with plants and worms. After setting up a water cycle students can observe and discuss what forms on top of their containers, how it got there, what happens to it after some time passes. They can record and analyze how the rain-making process takes place and compare it to nature's way of making rain.

4. Students can make a bulletin board or large collages using pictures which illustrate the forms and uses of water in the world.

5. Students can measure the amount of water or liquids used to make a variety of water-based foods or beverages.

6. Weigh fresh fruit, then dehydrate for several weeks and weigh again. Fruit can be dehydrated in the oven. Students can graph and compare the percentage of water in a variety of foods.

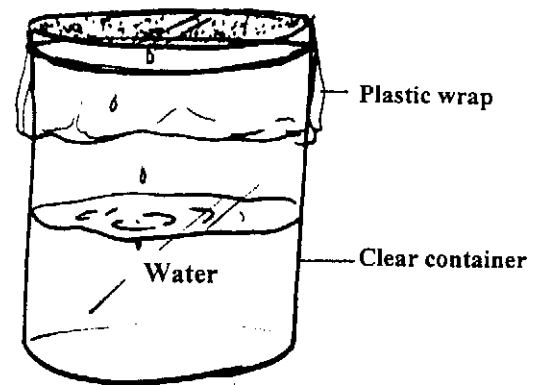
7. Based on various sayings, for example "When it rains, it really pours," students can write a creative one-page story.

8. Invite resource persons to visit your class and talk on water-related topics: uses of water, water company, purifying drinking water, water sports, having an aquarium, etc.

Assessments:

- Allow students to use the world map to locate and list four oceans, two seas, and a river in each continent. Then let them look at their own country, state, city, or town. Permit them to keep a journal and bring in pictures, advertisements, cartoons, etc., that have something to do with water.
- Allow each group to make a different water-based food or drink, and find out how much liquid and dry ingredients are used to make a sample for the whole class.
- Design a variety of hands-on activities and allow the students to tell what each type of weather it causes. Students can draw pictures or attach a photograph to show what each form of precipitation looks like, for example, snow, hail, sleet, fog, etc.
- Using a dictionary, encyclopedia or a variety of trade books, students can identify various uses of water, draw

WATER CYCLE



pictures to illustrate uses of water and write a paragraph describing uses of water.

Further Challenges:

- Have students imagine what it would be like to live in a place where it rained every day or where it never rained at all. Have students create a Rain Forest or a Desert in one of the school hallways (one that is not used frequently or by a large number of students).
- Students can study various weather conditions.

Resources/References:

Children's Books:

Peters, L. W. (1991). *Water's Way*. New York, NY: Scholastic

Schmidt, E. (1989). *The Water's Journey*. New York, NY: NorthSouth

Teachers' Books:

Bird, J. (1983). *Science From Water Play*. London, England: Macdonald,

Braus, J. (Ed.), (1989). *Ranger Rick's Naturescope: Wading Into Wetlands*. Washington, DC: National Wildlife Federation

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Cobb, V. (1972). *Science Experiments You Can Eat*. New York, NY: Harper & Row.

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Donev, M.; Donev, S. & Gold, C. (1987). *Foodworks: Over 100 Science Activities And Fascinating Facts That Explore The Magic Of Food*. Ontario Science Centre. Reading MA: Addison-Wesley, .

Lind, K. K (1991). *Water, Stones, & Fossil Bones*.

Washington, DC: Council for Elementary Science, International and National Science Teachers Association.

Zubrowski, B. (1981). *Messing Around With Water Pumps And Siphons*. Boston, Ma: Little, Brown.

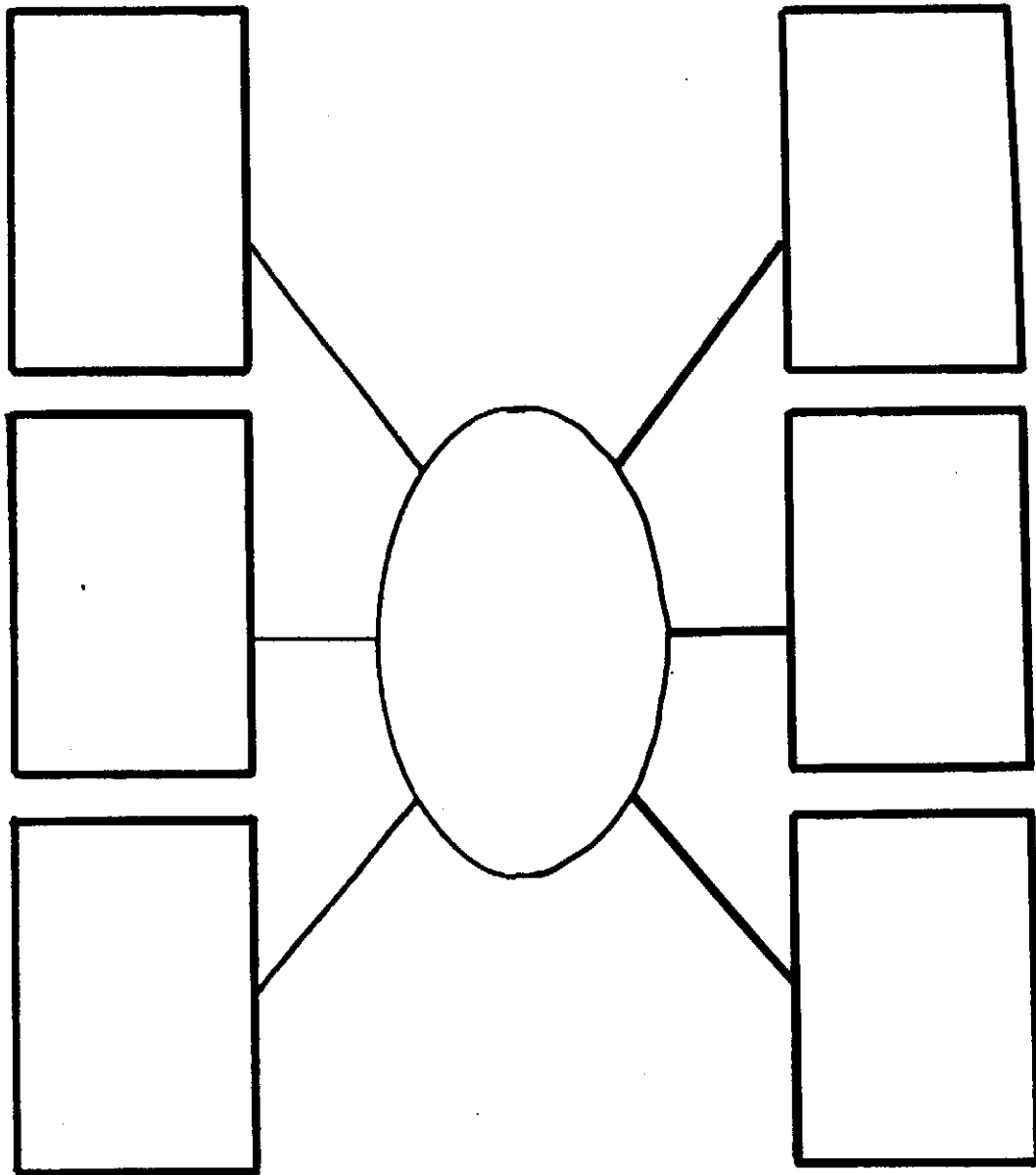
The Author:

Dr. Marilyn Irving is a Senior Training/Technical Assistant Associate (Grade Level K-6) at the Southwest Educational Development Laboratory.

Concept Map

33

Below is shown a blank concept map.



Start with any topic on your favorite piece of literature. Develop your own piece lessons. There can be any number of boxes surrounding the central theme. There can also be other boxes extending from the original set.

Clumps and Flocs: Construct a Miniature Mixing Basin

by Jan Erdman

Materials and Equipment:

- alum (found in spice section of supermarkets)
- water
- large dish or pan (a glass baking dish works well for underwater observation)
- soil
- tablespoon

Q What will happen when alum is added to dirty water?



Clumping action
of a flocculant.

Q Can the sunken particles be filtered out? What do they look like under a microscope?

Literature:

The Magic School Bus Inside the Waterworks by Joanna Cole

Focus:

Water treatment plants use chemicals and filters to remove dirt and other impurities from water. Among the chemicals used, alum is one of the most effective materials for removing soil and other suspended impurities. Common alum is aluminum sulphate with some potassium sulphate mixed in. It is a flocculant or material that attracts and holds dirt and certain other materials. It is used in reservoirs and settling basins as the first step in water purification. Alum is also used in pickle making. It attracts any impurities in the brine. Some flocculents are used in the petroleum industry. Nature's flocculant action is responsible for the formation of clays and silts on the floor of the oceans and beds of lakes and rivers.

Challenge:

Will the addition of a common chemical attract dirt and impurities in water? How can this action be used in cleaning water at water treatment plants?

Procedure:

1. Half-fill the dish or pan with water.
2. Add dry soil to the water and stir. Add soil a table spoon at a time. The water should be dirty but not be opaque with soil. Stir until the soil is in suspension.
3. Stir the water and soil mixture. Add alum a tablespoon at a time until you have added three tablespoons. The action of the alum should be evident immediately. If not, add another tablespoon of alum.
4. Make observations and inferences when alum is added to dirty water. Observe the clumping action of a flocculant. Continue to observe the mixture over a period of time. The alum should continue to gather soil particles and will sink to the bottom.

Further Challenges:

- Allow the soil, water, and alum mixture to sit overnight. Does time diminish or strengthen the effects of the clumping action?
- Add additional soil to the mixture after it has sat for an hour. Does the alum clumping still occur?
- Try the above experiment using different types of soil (potting soil, peat moss, backyard garden soil, etc.). Does each type of soil require more or less alum for good flocculation? Graph the results.

Resources/References:

- Cole, J. (1986). *The Magic School Bus Inside the Waterworks*. New York, NY: Scholastic Books, Inc.
- Cobb, V. (1986). *The Trip of a Drip*. New York: Little.

Note: Though there is nothing dangerous about alum, do not pour the mixture down the sink. The soil will clog the drain. Dispose of it by pouring it over any lawn area. The alum will not hurt the lawn.

Q Does alum lose its strength?
How do you know?

The Author:

Jan Erdman, Menasha Joint School District, Menasha, Wisconsin.

Materials and Equipment:

- large, clean, wide-mouthed jar - commercial pickle or mayonnaise size.
- heavy balloon piece - large enough to fit over the top of the jar.
- large rubber band
- water
- two chalkboard erasers filled with chalk dust.

Literature:

The Cloud Book by Tomie dePaola

Focus:

The clouds we see are really liquid water. As the moisture in the air rises higher in the sky, it loses its heat and condenses into tiny droplets. These droplets tend to cluster and cling to small particles of dust and dirt in the air. When enough droplets collect, a cloud is formed and we can see it.

Challenge:

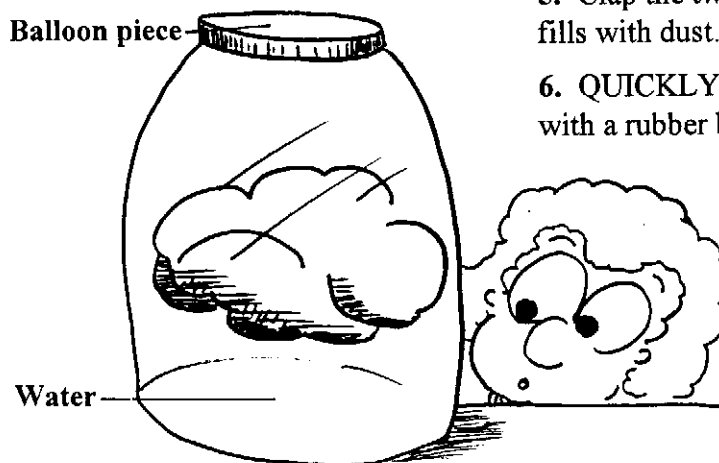
What is a cloud? How do clouds form? Can we make a cloud? Can we prove that a cloud is a combination of water and dust?

Two activities are listed below. Teacher demonstration is suggested. Both will form a cloud but teacher rehearsal is suggested.

Activity 1 - Cloud Model 1
Procedure:

1. Read *The Cloud Book* to the class.
2. Show pictures of clouds from book, charts, slides, video.
3. Discuss types of clouds and how they form.
4. Fill the jar with about two centimeters or one inch of water.
5. Clap the two erasers over the jar opening so that the jar fills with dust.
6. QUICKLY cover the jar with the balloon piece, secured with a rubber band.
7. Punch your fist into the balloon piece so that the balloon piece goes down into the jar.
8. Pull your fist out quickly and watch for the cloud.
9. Try making the cloud by following the same directions but eliminate the chalk dust.

CLOUD MODEL 1



Activity 2 - Cloud Model 2

Procedure:

1. Rinse the gallon jug out with water making sure that you dampen the inside of the jug and that you allow the excess water to drain out.
2. Light the match and allow the smoke to go into the jug.
3. Quickly place the jug on your mouth and blow into it. Make sure that you make a good seal between your mouth and the jug.
4. Watch for the smoke cloud.

Further Challenges:

- Try using other materials to make a cloud. Can you use soil or sand? Would these materials be too heavy to be able to rise high in the air? Would flour be a good material to try? Is pepper light enough to help form a cloud? Try these and other lightweight powders.
- Use a cloud chart and show the different types of clouds. Question which ones would hold the most water. Does the color of the cloud tell anything about the amount of moisture in the cloud?
- What really happens when it rains? Does the weight of the water in a cloud indicate whether rain will fall or not?
- Question why clouds disappear in the sky on sunny days. Does temperature aloft dictate whether evaporation will make a cloud disappear?
- Are clouds more likely to form over water or land? Explain.

Resources/References:

Children's Books:

- Ariane (1984). *Small Cloud*. New York: Dutton.
- Cole, J. (1986). *The Magic School Bus Inside the Waterworks*. New York, NY: Scholastic, Inc.
- dePaola, T. (1975). *The Cloud Book*. New York, NY: Holiday House.

Materials and Equipment:

- clean, narrow-mouthed gallon jug
- water
- wooden matches

Q Are all clouds alike?



The Author:

Jan Erdman, Menasha Joint School District, Menasha, Wisconsin.

Materials and Equipment:

- ice
- water
- shiny tin can

Q How can I see the water in my breathe?



Q How can we find out if there is water in the air?


Literature:

Magic School Bus Inside the Waterworks by Joanna Cole

Focus:

Water can be found all over the Earth, not only in lakes, rivers, and oceans, but in the air and in the soil.

All air contains some water, even desert air. Water in the air is invisible and is called water vapor. Dew is the condensation of water vapor in the air. When the temperature drops, the air can no longer hold all the moisture and this moisture condenses into droplets that we can see.

Water can also be found in all kinds of soil. Liquid water molecules are found in the spaces between the solid molecules of soil.

Challenges:

Do you think there is water in the air we breathe? Is there water in the soil?

Do you think we can capture some of this water to prove that water is found in the air and in the soil?

Activity 1: Air Contains Water
Procedure:

1. Fill the tin can with ice and water.
2. Allow the can to sit for about 30 minutes.
3. Observe the droplets of water on the outside of the can.
4. Where did the droplets come from? Does the can leak?

Further Challenges:

- Try replacing the water with soda. Taste the droplets that appear on the can. Are they soda or water droplets?
- Color the ice water and set the tin can on a white paper towel. What color are the water drops?
- Repeat the activity but do not add ice and use room temperature water. Droplets will not form on the outside of the can because there is no temperature difference.

Activity 2: The Air We Breath Contains Water

Procedure:

1. Give each group a mirror. Students should breath on the mirror and see the condensation of the water in the air they exhale.
2. What happens to the mirror? Where did it come from?
3. After several minutes ask if the condensation can still be seen. Where did the condensation go?
4. Does the temperature of the room and your own body temperature have anything to do with water from your breath condensing on the mirror?

Activity 3: Water in the Soil

Procedure:

1. Put some moist soil on a plate.
2. Cover it securely with clear plastic.
3. Place the plate in the sunshine.
4. Observe the water droplets which form on the underside of the plastic.
5. Where did the water droplets come from ?
6. How could we prove that they came from the soil ? [*Hint: Dry out the soil and repeat the activity*]

Further Challenges:

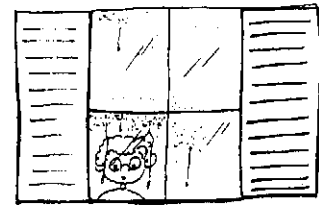
- Compare the speed of condensation by preparing another plate of soil and placing it in a cool, dark place. Why is there less condensation in a cool place?
- After droplets form on the plastic, place the experiment in a refrigerator for an hour. Remove the plate and discuss the difference in condensation between a warm, sunny place and a cold, dark place.

References:

- Cole, J. (1986) *The Magic School Bus Inside the Waterworks*. New York, NY: Scholastic, Inc
- Peters, L. W. (1991) *Water's Way*. Scholastic Books, Inc.
- Wegen, R. (1982). *Sky Dragon*. Greenwillow Books.
- Wyler, R. (1982). *Raindrops & Rainbows*. New York: Messner.

Materials and Equipment:

- mirrors



Materials and Equipment:

- small amount of moist soil
- plate
- clear plastic

Q How can water be collected from the soil?



Q How does temperature affect water condensation?

The Author:

Jan Erdman, Menasha Joint School District, Menasha, Wisconsin.

Which Trap Traps Best?

by Jan Erdman

Materials and Equipment:

- for all filters:
pencil, marker to mark cups
watches with second hands
- filter A:
2 heavy paper cups
10 cotton balls
dirty water
- filter B:
2 heavy paper cups
one paper towel
masking tape
dirty water
- filter C:
2 heavy paper cups
1/2 cup aquarium or pea size
driveway gravel
1/2 cup fine sand
dirty water

Literature:

The Magic School Bus Inside the Waterworks by Joanna Cole

Focus:

Construct three different water filters and observe the efficiency of each. Compare and contrast speed of water flow through different kinds of filters.

A water filter may be as simple as a clean handkerchief or as complex as those found in the water treatment plant of large cities. The principle is the same regardless of size - sediment and impurities are trapped both by the rough edges of filtering material and by the speed of the flow of water through the filter. This activity may take some time in preparation and you may wish to have each group make one filter and then compare the filters with the whole class.

Challenges:

What materials can be used to filter impurities from water? If we made three kinds of filters, will we be able to see which filter made the water clearer? Does the length of time needed for filtering have anything to do with how clean the water will come out?

Procedure:

1. Make dirty water by stirring soil into a quantity of water. You may wish to add small plant debris, small pieces of paper, etc.
2. Prepare the following filters:

Filter A

Mark an A on the outside of one of the cups. Make a small hole in the bottom of the cup with the pencil point. Place the cotton balls in the bottom of the cup and press them down tightly.

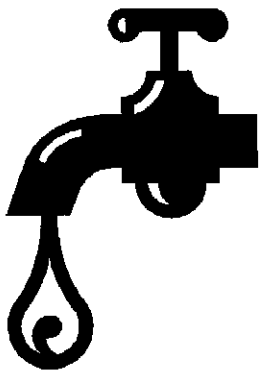
Filter B

Mark a B on the outside of one of the cups. Make a small hole in the bottom of the cup with the pencil point. Open the paper towel and push it down to the bottom of the cup. Tape the towel ends to the outside of the cup.

Filter C

Mark a C on the outside of one of the cups. Make a small hole in the bottom of the cup with the pencil point. Pour in

Q How is my drinking water filtered?



Q What impurities cannot be filtered out?

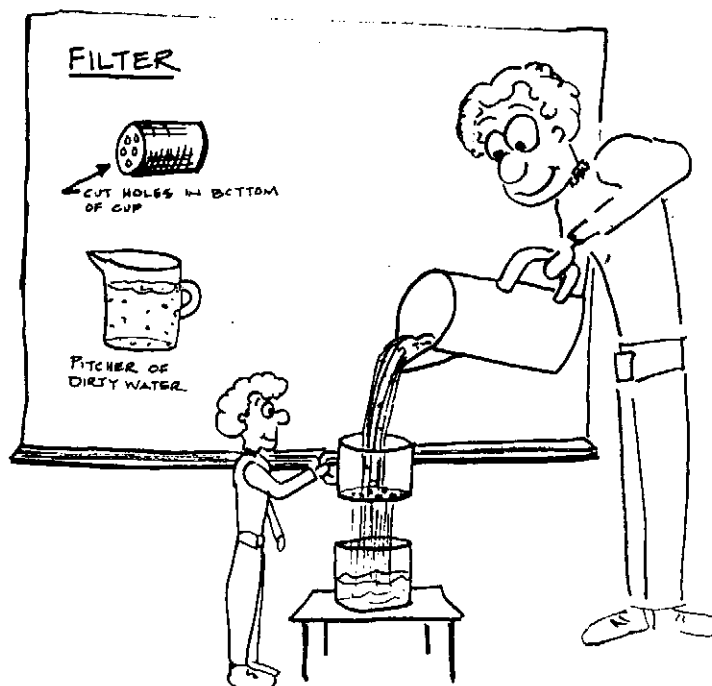
the sand. The sand should be on the bottom. Place the gravel on top of the sand.

3. Working with one filter at a time hold a clean cup under the hole in the bottom of the filter cup. Slowly pour about 1/2 cup of the dirty water into the filter. Time the filtering process.

4. Observe the filtered water as it drips into the clean cup.

5. After testing each filter discuss:

- Which filter makes the water clearer?
- Why do you think one worked better than the others?
- Which filter took the most time to drip through?
- Do you think that the length of time needed for filtering has anything to do with how clean the water will come out? Why?
- Is the same amount of water collected from each filter?



Further Challenges:

- Use water from different sources instead of making dirty water. Collect samples from local ponds or lakes. Which filter works best for these kinds of water?
- Use a stop watch or clock to time the flow through the filters. Which one filters fastest? Slowest?
- Collect the filtered water from the first experiment. Then refilter this water using new filters. Does a second filtering make the water even more clean?
- Are other filtering materials even more efficient than the materials used in the three filters? Try using coffee filters, cotton fabric, facial tissue, etc.
- Look at the unfiltered water under a microscope before filtering. Put a drop on a slide and observe. Look at a drop of the filtered water with a microscope. Is there a difference? Make sketches of drops before and after for each filter.

References:

Cole, J. (1986). *The Magic School Bus Inside the Waterworks*. New York: Scholastic Books, Inc.

The Author:

Jan Erdman, Menasha Joint School District, Menasha, Wisconsin.

Not All Waterworks Are Created Equal

by Carol Van De Walle

Literature:

The Magic School Bus at the Waterworks by Joanna Cole

Focus:

Water treatment is an extremely important issue for our health and safety. Ms. Frizzle's class provides an entertaining reinforcement and/or background information for the students about the process used to treat drinking water. The students have an opportunity to see how water is acquired for the community, cleaned and sent to their homes and school. Following the water from the school, its return to nature completes the cycle. Using this book allows students to review their trip and compare and contrast it with Ms. Frizzle's class.

Challenge:

How does our local water treatment facility compare to the one Ms. Frizzle's class visited?

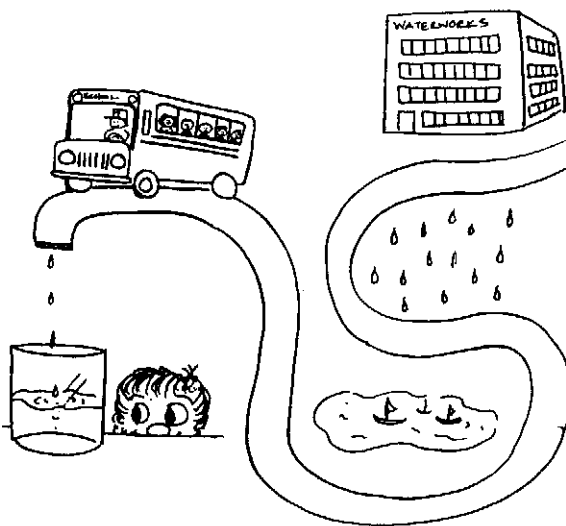
Procedure:

1. Take a trip to your local waterworks. If a class trip is not possible, invite a speaker from the local waterworks to talk to the class. Encourage them to use visual aides (ie. pictures, video tape, etc..)
2. Following the trip to the local waterworks read *The Magic School Bus at the Waterworks*.
3. Students can compare their local waterworks with Ms. Frizzle's class trip to the waterworks..
4. Students can draw and label the steps involved in their towns water system. Text can be added to photos taken at the waterworks.
5. Ask the children to identify the ten steps presented in the *Magic School Bus at the Waterworks* that show what happens to water from evaporation to arriving at their homes.

Make a chart of their answers. Ask children to decide which of the things described in the book happen to their water also. For those not selected ask them to describe why it is not done to their water. Ask children to add the steps for cleaning water and returning it to nature that Ms. Frizzle's class did not see.

Materials and Equipment:

- a worksheet, sample is shown on the next page.



Assessment:

- Draw the steps in acquiring water for our school. Include all steps from the natural source to becoming drinking water in our building. Label all parts.

Further Challenges:

- Investigate the local sanitary(sewerage treatment) system. How is the used water cleaned before being returned to nature? Where does it reenter the environment?
- Have groups of students write a book that takes Ms. Frizzle's class on a similar trip to a sewerage treatment plant.

References:

Children's Books:

Cole, J. (1986) New York, NY: *Magic School Bus at the Water Works*. Scholastic, Inc.

Teachers' Books:

Butzow, C. & J. (1989). *Science Through Children's Literature*. Englewood, CO: Teachers Ideas Press.
Project Wild Aquatic. (1987). Boulder, CO: Western Regional Environmental Education Council.

The Author:

Carol Van De Walle, Audubon Math/ Science Elementary School, Rock Island Illinois.

Waterworks Worksheet

List the ten steps presented in The Magic School Bus at the Waterworks that shows us what happened to water from evaporation to arriving at our homes.. The first one is done for you. Next check mark the ones in our Waterworks that we learned happened to our water. For those not check marked, explain why it is not done in our Waterworks. Add the steps for cleaning our water and returning to nature that Ms. Frizzle's class did not see.

Ms. Frizzle's class	My Town:	Reason for not taking this step in My Town
1. Water Evaporates, forms rivers, lakes.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.
5.	5.	5.
6.	6.	6.
7.	7.	7.
8.	8.	8.
9.	9.	9.
10.	10.	10.

Inquiring Minds Want To Know

by Jan Carpenter and Amy Douglas

Literature:

Hurricane by David Wiesner

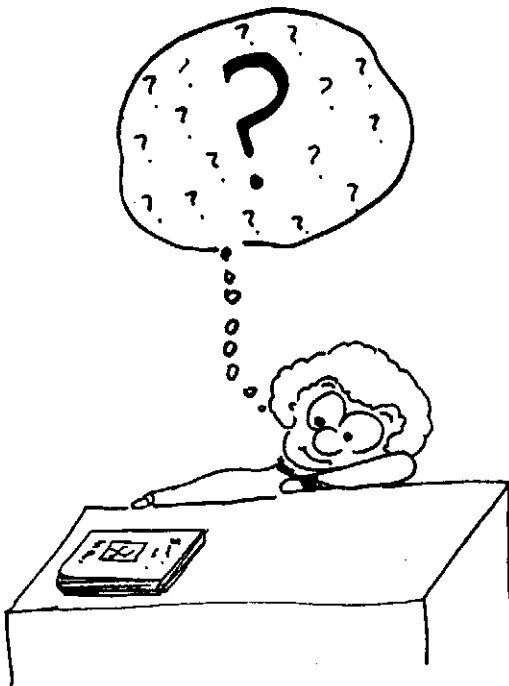
Focus:

A first step to encourage inquiry in young children is to identify topics appealing to students and appropriate for meeting the requirements of the science curriculum. Once a topic is selected through teacher and student collaboration, questions about the topic can be generated and routes for determining the answers discussed. A chosen route might involve experimentation, literature review, observation or any other plausible search tool(s) students find pertinent. The route chosen is investigated by the child and information on the topic is gathered. The information is then checked by alternate sources for accuracy, and finally presented to the class. The teacher's role is that of a guide and resource. The following activity is designed primarily to demonstrate the varied resources and strategies useful in locating information, and to provide students with an opportunity to communicate as scientists.

Challenges:

The most important challenge for students is the generation of research questions. The overall focus of this inquiry challenge centers on hurricanes but students may prefer to examine other weather phenomena like tornadoes or hail storms. The teacher must judge the appropriateness of student generated questions and guide students in constructing meaningful questions. Previous experience with the structure and nature of scientific questioning will, of course, facilitate the construction of meaningful questions. Some possible research questions that might be generated include the following:

- How do hurricanes get started?
- Where do hurricanes occur?
- How do we track hurricanes?
- What are the factors that affect the speed of hurricanes?
- What impact do hurricanes have on people, the economy, the environment, and animals? (4 separate questions)
- Why do hurricanes occur at certain times of the year?



- What precautions do people take when they are in the path of a hurricane and why?
- Why are hurricanes named and who is responsible for naming them?

Procedure:

1. A great introductory activity to move students' thinking toward generating questions about hurricanes is to track the path of a current hurricane on a daily or even every few hours if you have access to a NOAA weather radio station. If you don't have access to real data you can create your own. Call out the longitude and latitude coordinates and have the students mark the spot on their individual maps. If students have not been exposed to longitude and latitude, show them on a class map, or a map on the overhead, where to place their mark. Once the first mark has been made have students make predictions about where the hurricane will go next. Hopefully, students will quickly learn about the unpredictable nature of weather. Keep a class record of their predictions so graphs can be made. This activity can go on for as long a time or as short a time as you choose. Construct a class map and have individual students describe what they learned from the mapping activity.

2. To initiate further discussion on hurricanes read David Wiesner's book entitled *Hurricane* to the entire class.

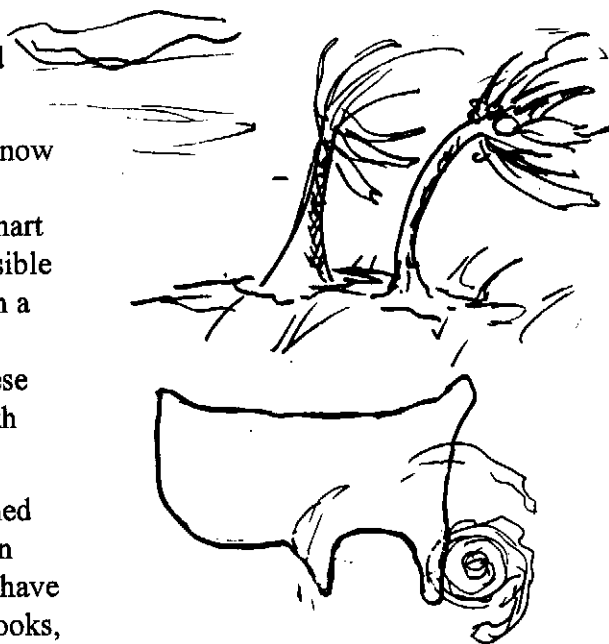
3. Hold a brief discussion on what the children already know about hurricanes. Allow them to share their experiences aloud with the whole group. Place these ideas on a big chart or piece of posterboard and put the list in an easily accessible place in the room so students can add to it or refer to it on a daily basis. As a whole group ask students to generate questions they might have about hurricanes and place these on an easily accessible chart as well. Always discuss with students possible ways to investigate their questions.

4. This activity is perhaps most effective when approached as a team project. Group size may vary, but no more than four or five to a group increases the chances that all will have opportunities to participate actively within the group. Books, maps and other materials should be easily accessible to students.

To establish the student groups, take the set of questions generated by the students and categorize them into several broad topics, such as weather conditions, impact on economy, naming of hurricanes etc.... Have students rank order the categories using a secret ballot format. Next place students in one of the topic categories in which they indicate

Materials and Equipment:

- People who have experienced hurricanes
- Scientists- meteorologist, biologists, ecologist etc..
- Laminated maps with longitude and latitude
- Erasable markers
- NOAA Radio Station



an interest. Once the group members have been identified have the teams get together and divide the topic into sub-topics for study. Have each student identify the sub-topic they are most interested in and then generate a list of questions about the sub-topic. Students may assist one another in developing questions but discourage duplicate questions. Four to five questions for each group member should be generated. Have the students turn in their questions for your approval and to allow you to begin guiding your students as they research their questions. I often ask questions like, "What do you think a meteorologist would want to know about your topic?" Or "What about a biologist?" "Do you think a geologist might find your question interesting?"

Sample Plan of Action

Name:

Group Topic:

Sub-Topic:

Questions:

Methods for finding information:

Resources for finding information:

Ideas for Presenting Information to the Class:

Timeline:

Questions due:

Answers due:

First draft due:

Final Draft due:

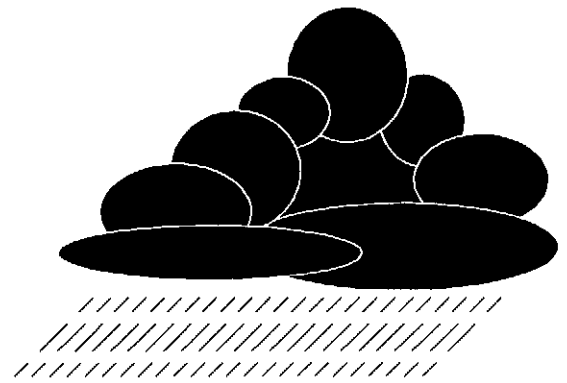
Presentation:

5. Once questions have been selected, have the groups come together and share ideas about how to find the answers to the questions. If guidance is needed, suggest to students that they determine if an interview, a controlled study, observations, books, or some other method(s), would best assist them in finding the answers. Students can then generate a list of possible data resources, such as experiments, people, books, graphs, charts. Finally, students can create a plan of action for completing the project. The plan should include the topic and sub-topic to be covered, the questions to be answered, resources and methods to be used, and ideas for presenting what was learned so all can learn about the topic. A time frame for completing the project should be developed and agreed upon by all participants. The teacher should review each student's plan and return the plan with either an approval to proceed or with questions that will lead to desired revisions.

6. Present the students with informative science articles throughout this experience. The articles may be read aloud, or available for silent reading. Remind students that an important goal in scientific writing is to share in a clear, precise manner what they know. The ultimate goal for each group is the production of a series of informative articles on their topic to be published in a class scientific journal on hurricanes. Remind each group that it is in charge of one section of articles to be included in the journal. Each group member must contribute one article to their section. Allow students to generate a title for the journal and each individual section. You can decide how to put the journal together in final form. Stapling may be satisfactory, however other forms of binding may be more appropriate.

7. At this point, students begin their research. When several group members locate the answers to their questions, a group meeting is held to discuss the findings. New questions may be generated at this time. The students check for discrepancies, duplicates or any unanswered questions. Any problems or new questions identified should be recorded for later research.

8. When students have recorded their answers they are ready to generate a rough draft of their article. Whenever a draft is completed it should be taken through an authoring circle where students listen to each other's work providing complements and suggestions for clarification or improvement. The focus during the authoring circle is on the accuracy and appropriateness of the content. It is important to have the groups reconvene once all members have completed a final draft. The group itself can then conduct an authoring circle and make suggestions for changes. The author should be allowed to disregard the suggestions of the group if he feels they are not appropriate. After revisions are made and the article is in final form, it is submitted to an outside editor, usually a parent, for syntax editing. After outside review, students make final revisions and add illustrations as needed.

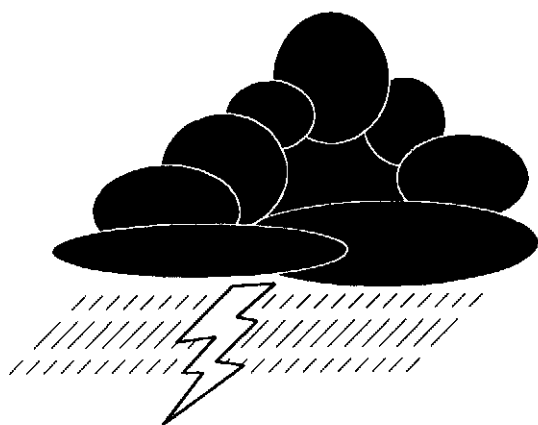


Assessments:

- Both individual and group assessment may be conducted throughout this activity. Most importantly the students are assessing themselves and each other through the authoring circle. In addition, a sign-up sheet where students describe their work daily in regard to their research and writing can be required. A plan of action provides students with a self-progress check, and the teacher can conference with individuals and groups to check on progress.
- Be sure to reexamine original questions to see that they were addressed appropriately. The groups can make oral presentations or a more creative type of presentation to teach the class what they learned. A test can be developed from all of the groups' questions and given after the presentations. Videotaping and reviewing the presentations assists in test preparation. A short answer format where students list two or more things they learned under each topic may be used.

Further Challenges:

- Another activity to challenge student's thinking involves asking students to prepare for hurricane landfall based on



data they have collected. For example, have students imagine they live in a hurricane prone area such as the Atlantic or Gulf Coast. Select some coastal cities as well as inland locations. Have the students keep track of a real or imaginary hurricane's path and on a daily basis have them write down in a journal how they might respond if they were residents of each area. Questions they might respond to include: What are you doing to prepare for the hurricane? Have you noticed any changes in the behavior of wildlife? What are the civil defense agencies saying or demanding? What do you think you should do today in relation to the hurricane? If you decide to leave your home, what precautions will you take? If you stay home what precautions will you take?

- Another activity might involve students in designing a plan for warning area residents about inclement weather, and/or an evacuation route.
- You can also have students investigate any other weather related disasters, such as floods, droughts and blizzards using this same inquiry format!

Resources/References:

Children's books:

Local Television Station Meteorologist

National Meteorology Society.

Simon, S. (1981). *Storms*. New York: Morrow Jr. Books.

Steele, P. (1991). *Storms, Causes and Effects*. New York: F. Watts.

Dineen, J. (1991). *Hurricanes and Typhoons*. New York: Gloucester Press.

Lampton, C. (1991). *Hurricane*. Brookfield, CT: Millbrook.

Fradin, D. (1982). *Hurricanes*. Chicago: Children's Press.

Branley, F. (1985). *Hurricane Watch*. New York: Crowell.

Bauman, B. (1992). *Hurricane Andrew, The Big One*. Longboat Key, FL: Metromedia Marketing.

Hugo Blue - poems, letters, stories published through Clemson University.

The Wrath of Hugo (1989). Pictorial works published by LTAPublishing Co.

Simpson, R. H. (1981) *The Hurricane and Its Impact*. Oxford: Blackwell.

The World Almanac and Fact Book. St. Martins Press

The Kids Almanac. St. Martins Press

Teachers' Books:

Hurricane Hugo -Interactive Multi-Media Computer Game/Laserdisc series by Turner Educational Services Incorporated

The Authors:

Jan Carpenter is a PhD student in Elementary Education at the University of South Carolina.

Amy Douglas is a Graduate Assistant in Elementary Education at the University of South Carolina.

EYE OF THE STORM: TORNADOES

40

by Carol E. Marxen and Joanie Larson

Literature:

Night of the Twisters by Ivy Ruckman.

Focus:

Differentiating how characters respond to emergency situations or the effects of tornadoes on individuals and communities are problems which invite student discussion. In addition, exploration of weather patterns which cause tornadoes to occur and safety action plans to survive this deadly natural disaster are concepts that may be developed.

Cyclone is a word which describes all types of rotating wind disturbances with low atmospheric pressure at the center. A tornado is one kind of a cyclone. Most tornadoes occur in the United States east of the Rocky Mountains in a region called *Tornado Alley*. However, tornadoes do appear all over the world, even over a body of water. A tornado over a body of water is called a *waterspout*.

Challenges:

- How do different characters respond to emergency situations?
- How do different characters accept responsibility for others?
- What are the effects of tornadoes on individuals and communities?
- What are some weather patterns that create funnel clouds and tornadoes?
- What actions should you take during a tornado watch? a tornado? after a tornado?
- How is low pressure formed?
- What are the effects of unequal air pressure? on structures? on humans?
- How is air pressure measured?

Formation of tornadoes. Tornadoes are a violently rotating column of air that descend in a funnel like form from a thunderstorm cloud system. Funnel clouds form when cool, dry air masses meet warm humid air masses. The warm air quickly rushes upward, sending winds into a whirling motion. A tremendous drop in barometric pressure at the core of the funnel is a result of the rapidly twirling vortexes. Tornadoes usually travel from southwest to northeast at a speed between 40 and 65 kilometers (25 to 40 miles) per hour. The rotating winds in a tornado may exceed 400 kilometers (250 miles) per hour.

An effect of tornadoes. The effect of tornadoes on buildings can be devastating. As a tornado passes over a building, the first effect is that of the very high velocity wind. These winds are very destructive. Later, as the center of the tornado passes buildings, the very low pressure outside any remaining building it surrounds while the pressure of the air inside the building still pushes out against the walls and can literally push the walls out.

Tornado safety action plan. Tornado warning signs are thunderstorms, hail, dark funnel shaped clouds, and a loud roar. A **TORNADO WATCH** means the weather conditions are such that makes tornadoes a possibility. During a Tornado Watch you should listen to a local radio or TV station and watch the sky carefully. A **TORNADO WARNING** is issued if a tornado has been sighted in the area. However, tornadoes develop suddenly and are short-lived so people have only a few seconds to act.

The following are tornado safety rules to follow during a tornado warning:

If you are at home:

- Stay away from windows, doors, and outside walls.
- Go to the basement or lowest floor in the middle of the house (under stairs or under a table). Get under something sturdy. Protect your head. Make your body as small as possible.
- Take a flashlight, and battery radio with you to the basement.
- If there is no cellar, go to a closet or a small room in the middle of the house.
- Cover yourself with a blanket or heavy towels to protect against flying glass and debris

If you are outside:

- Find the nearest ditch, ravine, or culvert. Lie in it face down, and cover your head with your hands

Materials and Equipment:

- bell jar
- vacuum pump
- balloons blown up a little and tied
- cup of warm water
- cork
- bottle

Materials and Equipment:

- string
- weight

Materials and Equipment:

- two inflated balloons
- (two apples with stems)
- string
- clothes hanger
- straw

Introduction:

Although the following explorations are written as demonstration or "recipe" lessons, they may be implemented as inquiry. Begin with questions about the tornado phenomena in *Night of the Twisters*. Allow students time to mess around with the materials and challenge them to make models and demonstrate phenomena to other students. Cooperative groups work well for these activities.

Air Pressure Explorations

Activity 1: What happens to objects in a low air pressure area?

Procedure:

1. Put several small balloons of different colors in the bell jar. What happens to the balloons as air is pumped out of the jar? *The balloons will enlarge as air is pumped out of the jar.*

2. Put a cup of warm water in the bell jar. What will happen to the water as the pressure is lowered? *The water will boil.*

Activity 2: What makes the air pressure so low in the center of tornadoes?

Procedure:

Swing a weight around your head on a string. What happens? The faster you swing it, the harder the weight pulled out. This is because it requires a force to change the direction of motion of an object. In this case the string provides the force to keep the weight from flying away. In a tornado funnel cloud the wind is whirling very fast. The whirling air molecules push against the air exterior to the whirling tornado until the lower air pressure at the center compensates to keep the tornado stable. The reduced air pressure in the center acts like the string on the weight.

Activity 3: Formation and effect of low pressure.

Procedure:

1. Attach a 60 cm (2 ft.) string to the top of each balloon.
2. Tie the ends of each string to the clothes hanger so that the balloons hang about 8 cm (3 in.) apart.
3. Hook the clothes hanger onto the wood molding of a doorway.

4. Wait until the balloons are motionless. Blow air through the straw between the two balloons or blow directly between the balloons. What happens to the balloons? *The balloons move together. Why? The fast-moving air between the balloons reduces the air pressure between the balloons, and the normal air pressure on the outside pushes the balloons together. This effect is most important for two ships traveling side by side through the water. They tend to crash into one another. It is, however, a good example of the complexity of the forces involved in the movement of air and the things it carries.*

5. The same concept can be demonstrated using two sheets of paper. Hold the paper about 8 cm (3 in.) apart and blow between them. *Once again, the moving air between them creates a low pressure area. Greater pressure on the outside forces the papers together.*

Activity 4: Will air pressure collapse a can?

Procedure:

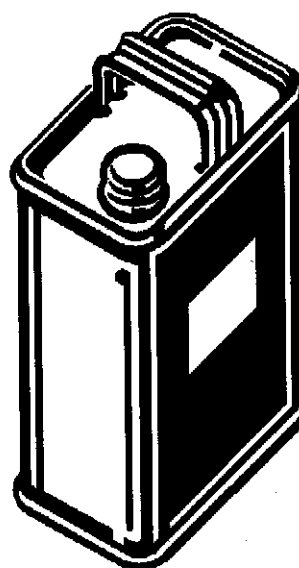
1. Cover the bottom of the can with about a cup of water.
2. Heat the can (without the cover) until the water reaches the boiling point and steam comes out of the opening.
3. Using pot holders, remove the can from the heat and immediately seal the opening with the cover. What do you think will happen? *The steam from the boiling water forces most of the air out of the opening of the can. The inside of the can fills with steam. After the can is sealed and cooled, the steam condenses and turns back into water. Air cannot get back into the can and a partial vacuum is created in the can. A low pressure exists inside the can and normal pressure outside. The higher pressure outside the can causes it to be crushed. How can you relate this to the low air pressure in tornadoes?*

A plastic bottle may be used in place of a can using the following procedure:

- Hold an empty plastic liter bottle without the cap into hot water.
- Allow some time for the air inside the bottle to become warm.
- Cap the bottle and remove it from the warm water. Run cold water over the sealed bottle. The bottle will collapse.

Materials and Equipment:

- one (or two) narrow-mouth gallon tin can(s) with screw-on cover
- pot holders
- hot plate
- water



Materials and Equipment:

- wide mouthed jar
- balloon
- straw
- toothpick or needle
- large cereal box
- white paper
- metric rules
- pen
- glue
- rubber band

What might happen to the following items inside a tornado funnel because of the low air pressure?

- Bicycle tires- *would probably not burst. They are designed to take high pressures.*
- Rubber rafts - *would probably burst. They are designed for only low air pressures.*
- Waterproof watches - *because these are probably airtight they might blow the crystal off. However, since they are designed to take high water pressure, the crystals are unlikely to break.*
- Corked bottles--full - *blow its cork and the liquid might start to boil or be sucked out*
- Freezers - *blow open*
- Safes - *not likely to blow open. If they were that easy to open they wouldn't be called safes.*
- Your ears - *would hurt because of bulging eardrums. In an extreme case the eardrums might break. Sound would be muffled because of the larger space in the inner ear. The same effect is experienced on a smaller scale when riding in a fast elevator, a plane, or going to a high elevation. By yawning or swallowing, we open the Eustachian tube so that the pressure can equalize and sounds return to normal.*
- A house with doors and windows tightly closed - *In normal conditions, the house is not completely airtight and the air on the outside exerts a pressure on the walls equal to that on the inside and the walls stay in place. But, when the air pressure outside falls suddenly and the inside air pressure is exerting a force of several thousand tons on the walls, they could fall down flat and the wind could take the roof away. The more likely scenario is that the house will be blown away by the initial high winds at the edge of the tornado.*
- A house with doors and windows left open - *An open house might remain in one piece, but things might blow out through doors and windows as the inside air blows out. Again, the structure is most likely to be destroyed by the initial high winds* (Adapted from Deery, 1985, p. vii, viii, & 10).

Activity 5: Make a barometer to measure the air pressure.

Procedure:

1. Cut the balloon so that it can be stretched over the top of the jar. Secure it with a rubber band.
2. Glue the toothpick to the end of the straw and glue the other end of the straw to the stretched balloon.
3. Glue the white paper to the center of one side of the box.
4. Make 11 marks on the white paper, each 3 mm apart. Write the numbers 0 through 10 at these marks.
5. Place the box next to the jar so that the straw normally points to the 5.
6. Take and record barometric readings. Correlate these readings with observed changes in the weather. How does high air pressure effect the weather? Low air pressure?

Activity 6: Discussion questions on air pressure related to *Night of the Twisters*:

- How do these explorations on air pressure explain the strange sucking sound the drains were making?
- Explain why the windows in the house exploded, the glass shower door shattered, and the windshield in the police car popped.
- Why do you think the water was rising on the shower floor?
- Why were Dan and Arthur concerned about the smell of gas? Where was it coming from?

Further Challenges:

- The effects of changing air pressure on the human body may also be explored and researched. What was meant by the statements: there was a "pulling in ears as if there were vacuums on both sides of my head" (p. 49), "my ears popped" (p. 52), and "I was feeling the sucking this time. It was like something trying to lift my body right up off the floor" (p. 54)? Have your ears ever popped? When? Why do you think they popped?
- Students may want to create models of the effects of low air pressure as Dan did. Recall for the students Dan's comment in the last chapter, "I . . . got an A on my science project. It wasn't easy, but I managed to demonstrate how radical changes in atmospheric pressure can cause sucking sounds in a person's drainpipes" (p. 150). How do you think Dan did this? What other effects of low air pressure could you demonstrate? How?

Models of a Tornado Funnel Cloud

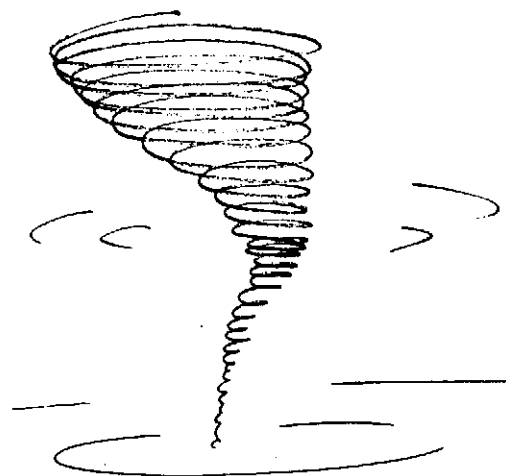
Activity 1: How can you show the shape of a tornado funnel cloud?

Procedure:

1. Put some pepper in a jar.
2. Fill the jar half full of water. Allow the pepper to settle back to the bottom.
3. Use the plastic knife to stir the water rapidly in a counterclockwise direction.
 - What shape does the water take as you stir? *The same shape as a tornado funnel cloud.*
 - What happens to the pepper as you stir? *The pepper begins to whirl with the water and forms a funnel shape.*
 - How does this activity relate to a tornado? *It forms the same shape as a tornado funnel cloud.*
 - How is the funnel in the jar different from a tornado? *The funnel in the jar displays the appearance of a tornado, not a real tornado.*

Materials and Equipment:

- pepper
- jar
- water
- plastic knife



Activity 2: Vortex Action: Tornado Tube

Procedure:

1. Fill 1 plastic, 2-liter soft-drink bottle half full with water.
2. Cover the opening of the bottle containing water with a strip of duct tape.
3. Punch a hole in the center of the tape with a pencil and turn the edges of the tape under the hole.
4. Turn the second plastic bottle upside down and line up the openings of the two bottles.
5. Wipe any water from the necks of the bottles.
6. Wrap strips of duct tape around the necks of the bottles to hold them together.
7. Turn the bottles so that the bottle with the water is on top. Grasp the bottles around the necks and quickly whirl them in circles parallel to the floor.
8. Set the bottles on a table and observe the motion of the water. What is the shape of the whirling water as it falls from the top bottle into the bottom bottle? *In the center of the whirling water is a funnel shaped pocket of air. This air pocket looks like a tornado. The whirling water creates a reduced pressure in the center. As the water falls into the lower bottle, the air from the lower bottle escapes to the*

Materials and Equipment:

- 2-1 liter plastic bottle
- duct tape
- water
- paper towel

upper bottle through this funnel What is a vortex? A whirling mass of liquid or gas forming a reduced pressure at its center.

Commercial tornado tubes may be purchased and used with plastic bottles.

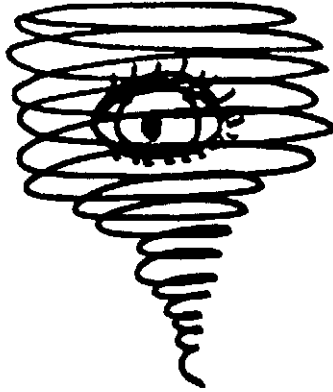
Resources/References:

Children's Books:

- Adoff, A. (1977). *Tornado! Poems*. New York: Delacorte.
- Archer, J. (1983). *Tornado!* New York: Macmillan Child Group.
- Armbruster, A. & Taylor, E. A. (1993). *Tornadoes*. New York: Franklin Watts.
- Baum, L. F. (1982). *The Wizard of Oz*. New York: Henry Holt.
- Bowman, J. C. (1961). Pecos Bill busts the cyclone. In *Pecos Bill* (pp. 211-224). Chicago, IL: Albert Whitman.
- Branley, F. M. (1985). *Tornado Alert*. New York: Harpertrophy.
- DeJong, M. (1970). *A Horse Came Running*. New York: Macmillan.
- Gleeson, B. (1993). Ride 'em, Round 'em, Rope 'em: The Story of Pecos Bill. In Amy Cohn (Ed.), *From Sea to Shining Sea*, (pp. 286-289). New York: Scholastic.
- George, J. C. (1986). *One Day in the Prairie*. New York: Crowell.
- Grigsby, G. (1978). *Tornado Watch*. Columbus, OH: Ohio State University.
- Ruckman, I. (1984). *Night of the Twisters*. New York: Thomas Y. Crowell.
- Shore, J. L. (1977). *Summer Storm*. Nashville: Abingdon.
- Simon, S. (1989). *Storms*. New York: Morrow.

Teachers' Books:

- Braus, J. & Marshall, J. (Eds.). (1985). *Naturescope: Wild About Weather*. Washington DC: National Wildlife Federation.
- Buehr, W. (1972). *Storm Warning: The Story of Hurricanes and Tornadoes*. New York: William Morrow
- Deery, R. (1985). *Tornadoes and Hurricanes*. Carthage, IL: Good Apple.
- Donnelly, J. & Kramer, S. (1993). *Read it to Believe it! Survive! Could you?* New York: Random House.
- Friedl, Alfred E. (1991). *Teaching Science to Children: An Integrated Approach*. New York: McGraw Hill.
- Ogle, D. (See Readence citation below-pp. 199 -201).



Readence, J., Bean, T., & Baldwin, R. S. (1992). *Content Area Reading, An Integrated Approach*. Dubuque, IA: Kendall-Hunt.)

The following publications on tornadoes are available from the Superintendent of Documents, U.S. Government Printing Office, Washington DC

NOAA/PA 75012 *Owlie Skywarn's Tornado Warning*

NOAA/PA 82001 *Tornado Safety: Surviving Nature's Most Violent Storms*

NOAA/PA 76019 *Skywarn: Seconds Save Lives!* (8 1/2" x 11" poster)

The Authors:

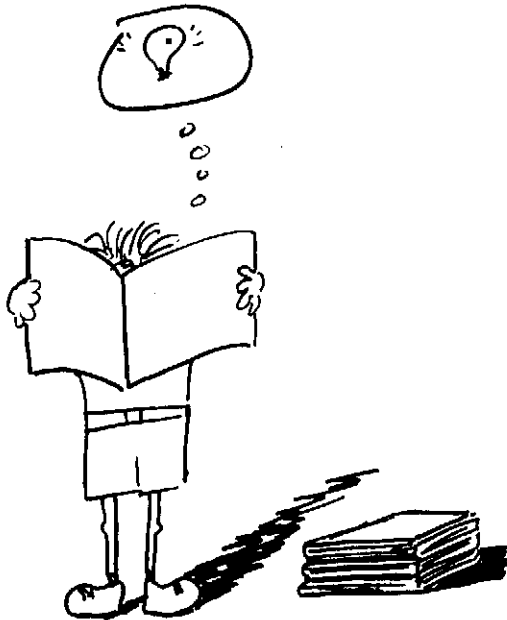
Dr. Carol Marxen, Assistant Professor of Education, University of Minnesota, Morris, Morris, Minnesota.

Dr. Joanie Larson, Assistant Professor of Education, Emporia State University, Emporia, Nebraska.



Materials and Equipment:

Since students will be using trade books of their own choice, the materials and equipment that they will need will be quite varied. However, it is probably best to give students an idea of all the "support" equipment that they truly have at their disposal. For example, teachers might take their own favorite trade book and supply examples of the types of labs that could be created. It would be best if the spin off hands-on activities involve easily obtainable materials (cans, paper, batteries, thermometers, candles, balloons, etc.).

**Focus:**

Science trade books can be used by students to design their own labs. Trade books provide a wealth of information through text, pictures, and activities. There are always a multitude of spin-offs that can result from any trade book! Although it can be helpful for the teacher to have labs in mind that might result from a particular trade book, there is no requirement that one necessarily be a science expert.

Challenges:

What experiments could you design using the information in a trade book?

Which of the ideas presented in the trade book could be tested?

Are the ideas in the trade book true? How could you test them?

Procedure:

1. Share a trade book with the entire class.
2. Supply an example "spin off" labs developed by previous students for a trade book. If this is the first year for the activity, then the class might work together to develop a large group lab for the entire class. An alternative is for the teacher to present his/her own examples of a lab (experiment) that could be created with the particular trade book.
3. Students are broken into groups of 2, 3 or 4. Within their groups they work with a particular trade book of their choice to develop an experiment that involves some topic presented in the trade book. The success of this step will greatly depend on the amount of science that has been done within the classroom and the age of the students. Students of lower elementary grades will probably not be able to easily develop their own activities, but they would be able to carry out teacher created labs from the trade books.
4. Students create their labs from the books, try out their labs, and then present their results to the class.

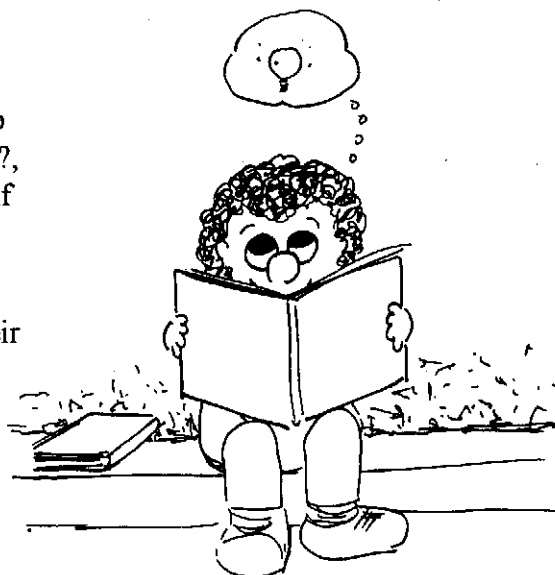
Assessment:

Since students' projects will be as unique as each trade book, an assessment can be very difficult. Probably the most useful and reasonable assessment would require students to provide a science fair type report for the rest of the class.

This would require students to combine the "science" they have done with "communication" skills. Key questions teachers might ask of each student: 1) why did you develop the lab?, 2) what worked during your development process?, 3) what did not work during the lab development?, and 4) if you had more time what would you do next?

Further Challenges:

- Students could be asked to develop a volume "II" of their favorite trade book, but this volume would have to include lab activities as well as text.
- Often students enjoy creating a "class" book of labs developed from trade books. This compilation of labs could be used to provide examples other classes could follow.
- Students could present their trade book derived experiments to other classes.
- Students could produce their own trade book and include labs that could be used with the text.
- Students could write the authors of the trade book and send them descriptions of their labs.



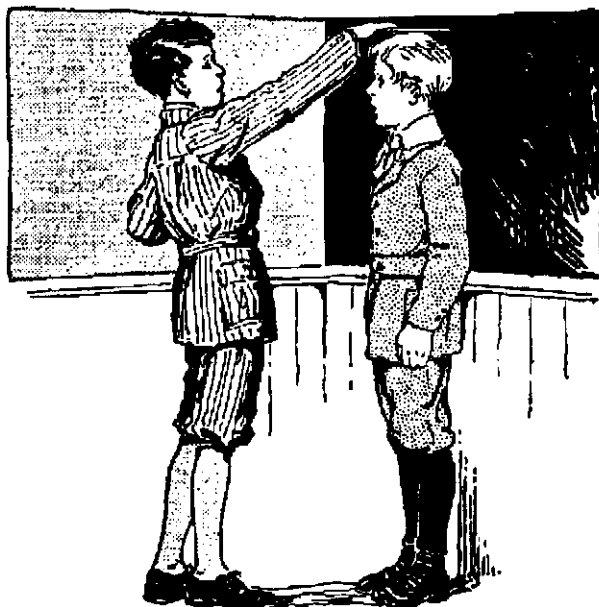
Resources/References:

If your science textbook is not particularly full of hands-on science labs then consult:

1. The other CESI Sourcebooks.
2. Recent science teacher magazines that target elementary students.

The Author:

Dr. William Boone is a professor of Science Education at the School of Education, Indiana University.



Materials and Equipment:

- A wide variety of children's literature that focus, even remotely, on an aspect of science. (See section entitled REFERENCES for suggestions).
- Blank Books (hard covered books with blank pages that provide young authors with a professional-looking format for their writings. May be purchased from: Sundance, P.O. Box 1326 Newtown Road, Littleton, MA 01460). If "blank books" are not available, student made "mini-books" may be substituted.
- Chart paper
- markers
- crayons.

Focus:

After becoming familiar with a variety of children's literature (fiction as well as nonfiction) students will learn to become authors and create books in various genres that focus on scientific concepts. Students will then share their writings with other children, both formally and informally, confident that they have successfully achieved the status of "author".

Challenges:

What has been your favorite picture book, poem or short story focused on a scientific theme? Why was this your favorite? What, specifically, made this piece of writing attractive to you?

What has been your favorite chapter book/novel that focused on or included a scientific theme? Why was this your favorite? What, specifically, made this piece of writing attractive to you?

What was the "genre" of this writing? (A mini-lesson on "genre" might be appropriate prior to discussing this question.) What did you like about the author's style of writing?

Activity 1: Literature Immersion**Procedure:**

1. For several weeks prior to the start of the writing portion of this lesson, students should be immersed in literature that focuses, in some way, on a scientific theme. Teachers may decide to select books that focus on a specific theme or choose to expose the students to a variety of themes simultaneously. Students should not only read for themselves, but also be read to and given time to examine these books. (See RESOURCES for some suggested titles). It is important that these books be displayed in the classroom so that they are easily accessible to the students.
2. After reading, large and small group discussion of the books is a MUST. Students should be given ample time to express their opinions verbally, and in written format, about the content material in the book as well as the author's literary style and writing techniques.
3. Important elements of these discussions should be recorded on chart paper and displayed around the classroom

for the students to later use as a reference. Other activities that could take place at this time might include the following:

- Compare and contrast two or more books that focus on the same scientific content.
- List and discuss the "scientific" vocabulary that was included in the book. Students may wish to create a picture dictionary for these special scientific words.
- Discuss the different genre of the books that were read and generate a list of important elements in the genre.

At this point, after students have heard the comments and opinions about some of the books that were read by other students in the class, they may want to have more time to read those books.

Activity 2: The Writing Process

Procedure:

After this "immersion" into literature students are now ready to begin the writing process:

1. Students should first begin by selecting an area of science or scientific topic that is of particular interest to them.

Additional nonfiction science material on these topics should be brought in at this time as references. Students should be encouraged to do some research into their scientific topic in order to include in their story some scientific facts. Discuss ways students can relate scientific facts to a fiction story. Refer back to previous discussions of the other books that were read and how the authors incorporated the scientific concepts.

2. Brainstorm all the ideas that come to mind on this topic. ("Webbing" is an excellent technique to help generate ideas)

3. The most crucial element of any story is the plot. Students should list a variety of plot possibilities that revolve around their selected "scientific topic". At this point, discussion is essential. One on one or small group (3-5 students) discussion will help students to clarify their own thought on their plots and also to help one another with additional thoughts and ideas.

4. It is suggested that students create a simple outline of their plan for the story prior to beginning the rough draft:

- I. Introduction: How will they introduce the plot ?
- II. Middle: What will be the "problem" solved ?
(the plot)
- III. Conclusion: How will the problem be solved/resolved ?





5. At different grade levels you may wish to have the students brainstorm further before writing -- particularly for characterization. Students should "get to know" their characters by writing paragraphs about the main characters that describe their physical appearance as well as their personalities, likes, dislikes.

6. Once the brainstorming process is over (this is a long process and the most important step in the entire writing) students are then ready to begin their piece of writing. Throughout the entire process students should be constantly discussing ideas with each other, revising and editing.

7. Once the story is complete and in its final form students will then be very excited about writing their story into their very own "blank book". Planning is necessary prior to beginning this step in order to place illustrations on the correct pages. Students should write and plan their books modeled on the books they have been reading: title page should be included, a dedication if desired, and an "About the Author" paragraph could also be included on a back page or on the back cover. A small school photo is a nice addition to this section.

8. After the books have been completed the best is yet to come: reading and sharing the stories with each other, as well as other classes. Most students will be proud to read their stories aloud to their classmates, especially to children who are in younger grades.

The experience of reading fiction and nonfiction that has focused on a scientific topic, followed by numerous discussions and then writing stories of their own will prove to be a most worthwhile endeavor for both students and teachers.

Further Challenges:

This activity can be further extended by having students create "Big Books" of certain genre or writings on a specific scientific theme. After a unit of study students may then be asked to create a piece of writing that includes that particular scientific concept.

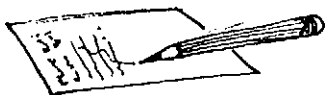
Resources/References:

The following books are only a few of the many picture books and novels that can be used for this activity:

Baker, Jeannie
Barrett, Judi
Brown, Ruth
Carle, Eric

Window
Cloudy with a Chance of Meatballs
The World that Jack Built
The Grouchy Ladybug

Cherry, Lynne	<i>The Very Hungry Caterpillar</i> <i>Papa, Please Get the Moon for Me</i> <i>The Great Kapok Tree</i> <i>A River Ran Wild</i>
Cole, Joanna	<i>The Magic Schoolbus: Inside the Human Body</i>
Cole, Joanna	<i>The Magic Schoolbus: Inside the Earth</i> <i>The Magic Schoolbus: At the Waterworks</i> <i>The Magic Schoolbus: Lost in the Solar System</i> <i>The Magic Schoolbus: On the Ocean Floor</i>
Danziger, Paula	<i>Earth to Matthew</i>
Durell, Ann	<i>Big Book for our Planet</i>
Geisel, Theodor Seuss	<i>The Lorax</i>
George, Jean Craighead	<i>The Missing Gator of Gumbo Limbo</i> <i>Who Really Killed Cock Robin</i> <i>The Love Bug Connection</i> <i>Julie of the Wolves</i> <i>One Day in the Tropical Rainforest</i> <i>Shark Beneath the Reef</i>
Goodman, Roger	<i>A Bed for the Wind</i>
Guccione, Leslie Davis	<i>Nobody Listens to Me</i>
Hader, Bert and Elmer	<i>The Big Snow</i>
Moon, Pat	<i>Earth Lines</i>
O'Dell, Scott	<i>Island of the Blue Dolphins</i>
Paulsen, Gary	<i>Dunc's Dump</i> <i>Hatchet</i> <i>A Walk in the Rainforest</i> <i>Once There Was a Tree</i> <i>Trouble at Marsh Harbor</i> <i>The Sign of the Beaver</i> <i>The Hostage</i> <i>Just a Dream</i> <i>Quill's Adventures in Grozzieland</i>
Pratt, Kristin Joy	
Romanova, Natalia	
Sharpe, Susan,	
Speare, Elizabeth George	
Taylor, Theodore	
Van Allsburg, Chris	
Waddington-Feather,	
John	
Yanda, Bill	<i>Rads, Ergs and Cheeseburgers</i>
Yolen, Jane	<i>Owl Moon</i>



The Author:
Sue LeBeau is a 5th Grade
Teacher at the West End School
in Long Branch, New Jersey.

A Day on the Mountain:

Bringing *My Side of the Mountain* to Life!

by Mark Levin

Preface:

"My Side of the Mountain Day" has become a tradition for Carolina Day School fifth graders as we load up our students, teachers, and parent volunteers and head to a forested site in the mountains of western North Carolina for a full day of adventure, excitement, and education. Spending a day recreating the life and times of protagonist Sam Gribbley becomes a dream come true for students as they find out what it must have been like for Sam to survive in the wilderness without parents, siblings, or even "teachers."

"My Side of the Mountain Day" could easily be adapted for any age group that reads or has read to them the novel by Jean Craighead George. The activities included here are ready to go for third through sixth graders. The activities combine to cross all academic disciplines as science gets interwoven with language arts, math, and social studies. And there is certainly plenty of physical education activities as students hike up, down, and across the mountain.

Our program is scheduled to run the full school day with students returning home in time for their regular pick-up.

My Side of the Mountain, a Newbery Honor Book, was written by Jean Craighead George and has become a favorite book of children for over thirty years. The story is about Sam Gribbley, a New York City boy, who decides to leave his crowded apartment one day and head to the wilds of some old family land in the Catskill Mountains. His plan is to live by himself in the mountains for a year. He wants to prove to himself that he can survive on his own. He faces plenty of challenges to make this story exciting and believable; including the harsh winter elements, hunger, uninvited guests, and his own worries about whether he could make it or not.

Sam does indeed make it through the year and does it in style. His methods of dealing with his hardships are creative and stir the imaginations of the reader. My students can't wait to spend a day outside testing their theories and wits against the elements. "My Side of the Mountain Day" brings it all together as we relive the life, if but for a day, of Sam Gribbley.

Choosing a Site

We are lucky in that our school is located in the mountains of North Carolina. We have hundreds of thousands of acres of public and private lands available for our use, all less than an hours drive from school. We have chosen a couple of different sites over the years including private land and a nearby national forest.

An ideal site is one that is wooded, has a creek or two, and is semi-remote. While thousands of acres aren't necessary, the experience becomes more realistic when the students get the feeling that they are in "the wilderness." It really doesn't take a lot of land to get the feeling of being "one with nature." What matters most is that the feeling of the site is one of being outdoors and in nature, as opposed to being near brick buildings, sidewalks, and traffic.

It would be possible to do the program in a city park, on land owned by one of your families, or even on the school property if there is a wooded area away from the normal school activity. A forested area adds much to the realism, but any site could be used with some modification to some of the activities.

We've been lucky to find sites that had a simple cabin adjoining or on the property itself. We use the cabin as 'headquarters' for the day and as a temporary shelter from the cold. After all, Sam was able to build a shelter inside of a hemlock tree. We keep a kettle of water on the fireplace going to use for hot chocolate. Often we've been lucky to find a local 'authority' on the history of the area and have that guest stationed in the cabin to provide stories and insights into life in the real mountains throughout the day.

None of our sites have had any sort of indoor plumbing, and generally no privies either. This simple lack of 'modern necessities' adds to the realism of the experience. We prepare the students (and parents) beforehand to the fact that they will need to do what Sam did when nature calls. We do provide instruction in wilderness ethics for students and parents so that they can indeed find relief if needed. This has never been a problem.

As with any activity, on or off campus, there is always some risk of an injury. We have never had an injury during one of our "My Side of the Mountain Day" experiences, but we prepare just the same. We keep at least one vehicle with us at the site, have a well stocked first aid kit and the knowledge to use it, and know where phones are available. With today's electronic marvels, you may find a cellular phone gets a signal from your location. The school is left with a map to our site in case there is some emergency where they need to find us.

Common sense and preparation will help insure that your day is a safe experience. I've included our basic safety rules later in the chapter.

Picking a Day

There can be no right or wrong day for this experience since no matter what this program will remain in your students' memories for years to come. I have my classes read the novel starting in mid-fall so that we're finished around the end of November. I choose a day in early December since the weather in our mountains is fairly predictable around then. My ideal day is one where the temperature hovers in the mid-forties, and the sun is out. I've had one experience where it was overcast all day, the sun never shone through the trees, and the temperature never made it out of the thirties. We survived, and that day is still being talked about years hence.

I always set up an alternate date when choosing the first, usually two or three days after the original one. When requesting parent volunteers it is important to have both dates listed and get them to commit to both if at all possible. Our statement to parents is that we will only cancel if it is raining or snowing, or if the temperature and accompanying windchill make it so cold as to be either unsafe or completely unbearable. So far we've never had to cancel or reschedule. If we ever have to reschedule one date and then cancel the alternate, I would salvage what we could of the activity at school rather than completely disband the idea. It would be too much of a disappointment to scrap the experience.

I like choosing a day in the winter (or colder months of the year) since one of Sam's greatest obstacles was to make it through the winter. He describes in great detail what it feels like to be really cold, and providing this experience in the late fall or early winter does indeed get students to understand the situations Sam faced. However, any day in any season will make for a wonderful experience.

Getting Ready for the Day

Excitement runs high once we start reading *My Side of the Mountain* and unveil plans for “My Side of the Mountain Day.” We send a letter to parents soon after beginning the novel to announce our plans and recruit volunteers. We want as many volunteers as possible in order to keep our groups small. The smaller the group means the more hands-on experiences each student will have. A perfect size group for this experience consists of four students and one adult leader. I tell the students to pay particular attention to all the details of the novel as we read. Many of them duplicate Sam’s ideas for survival in their personal writing journals. They draw pictures of traps, shelters, and camp furnishings and their minds soar in anticipation of getting outside and trying their hands at ‘wilderness life.’

About three weeks before the big day arrives I hand out the Clothing & Equipment list for the experience. We go over it carefully and explain the reason for each item. If you are doing this experience in the colder months, it is essential that the students (and volunteers) have the proper clothes. I discuss the necessity of dressing in layers and having gloves and a hat.

I make sure this clothing list is attached to the permission slip so that parents are sure to see it. It is important that you go over the list again about four days before the day and hand out another copy. While it might be a good learning experience to forget some things on occasion, this is a situation where everyone needs to be prepared. It would be wise to have a third copy of the Clothing & Equipment list for each student on the day of the event and have a parent volunteer go over the list with each child as a final check before loading up for the adventure.

Additional Preparation

Go over safety rules with your classes a couple of days before the experience, and again on the morning of your trip. I’ve listed our rules below as a starting place for you to develop your own. It is important that your parent volunteers get a copy of these rules several days before the experience. If possible, hold a short after school training orientation for your volunteers. They’ll feel more confident about what to expect. I assure them that no outdoors experience whatsoever is needed to be a leader. Our parents are there mostly as onlookers and safety

CLOTHING & EQUIPMENT LIST

- Warm clothes - dress in layers
- Hat that pulls down over the ears
- Gloves
- Wool socks
- Rain parka/jacket/poncho
- Extra socks
- Day pack (book bag) to carry everything in

YOU WILL ALSO NEED:

- Bag lunch that doesn’t need heating. You can bring something already heated in a
- thermos. Don’t forget something to drink, either in a plastic water bottle or a canteen. You might want to bring an extra snack. Don’t bring anything in glass.
- Plastic mug if you want hot chocolate (we don’t provide Styrofoam cups)
- Water bottle or canteen (filled with water)
- Whistle (to use if you should become separated from your group)
- Field journal, pens & pencils
- Small amount of clothes dryer lint in a zip-lock bag (This is used as tinder for firestarting, one of the activities.)
- Spirit of adventure

DO NOT BRING:

- anything in glass
- knives, hatchets, etc.

NOTE: You must carry out everything you carry in, including trash.

monitors rather than active participants. We want the students to do all the activities on their own.

Have the students placed in groups before the day arrives. Again, we try to keep our groups limited to 4 students. We let the students meet with their group the day before the program to start making final plans. At this time they will receive a copy of the activities and they can work together to prioritize the order in which they wish to complete them. There are more activities on the list than they can finish in one day, so I choose some that I feel are “musts,” and tell them I encourage them to do as many others as they can. I also explain that I’m looking for quality in each of their activities, that they should not start a new activity until the one they are on is completed to the best of their ability.

Students will need to check-out needed “science” equipment before leaving for the experience. I have a check-out/check-in form and I do hold the students accountable for their supplies.

Sample Rules for Leaders & Students

Safety! Safety! Safety!

- o No rock or stick throwing
- o No running
- o Watch where you are walking for unstable footing, low branches, briars, etc.
- o Use common sense
- o Stay with your group at all times
- o Have a great time, but be safe!!

Notes for Leaders & Students

- Students in each group will stay with their group during the day. Each group will have an adult leader.
- This is not a race! Students are encouraged to work carefully to see that every step is completed to the best of their ability.
- Groups can organize their activities in any order, with the exception of the fire building. A time for this activity will be assigned to each group.
- Your group will decide when and where to eat lunch.
- Groups are reminded that we are guests in the wilderness and must return everything as we found it. We are to carry out every piece of trash we bring in, and we are encouraged to each bring out at least one piece of litter that was there before us.

Groups will need:

- a clipboard
- two measuring tapes (six feet in length or more)
- two thermometers
- two magnifying lenses
- one compass

Individuals should have:

- pencils
- pens
- field journal
- a site map (more on this in a moment)
- activities list.

It is wonderful if you can provide a site map for the students. It doesn’t have to be very realistic or drawn to scale. I include a landmark or two, a north directional arrow, and a couple of trails. I add to the excitement by giving certain areas wild and crazy names like “Falls of Doom” or “Site of the Landsford Tragedy.” Additionally, it’s fun to add a symbol for recent bear sightings. All of this is in fun and adds to the excitement of the experience. Of course a map can be very detailed and realistic if you have the time and talent to create one.

- Groups may not disturb any living thing - plant or animal. Any branches or limbs we use must be found on the ground. Leave animal homes undisturbed. For example, if we pick up a log to look under, we must carefully return the log to its original location.
- Students may not have a knife of any size. The adult leader may have one, but the adult alone will need to do any cutting. Challenge the students to find whatever they need in the right size, or find a "wilderness way" of cutting something if cutting seems to be an absolute must.
- Your groups may do your activities as far away from the other groups as you wish.
- Just remember that you do not want to be so far away you can't make it back for your fire building time, or for departure.
- The map is for general locating purposes only. It is not intended to be very accurate.
- We want the students to discover what is around on their own.
- If you should happen to get separated from the group, stay put! Use your whistle.
- We'll find you.
- If you need first aid, come to the cabin (or other suitable headquarters). Come as a group.
- Groups should be back at the vans ready to depart at _____ o'clock.

Notes for the Lead Teacher

I make myself available as the problem solver for the day's events. Usually, things go without a hitch; but be assured that if you have your own group - you'll be needed for some reason at four places at the same time. I've tried it both ways - with and without a group; and believe me - without a group is a necessity, not a luxury. I station myself around the headquarters area and help where needed. I enjoy visiting the other groups and seeing their handiwork. They are always proud of their accomplishments.

It's also a luxury if you can have another adult leader serve as 'Headquarters Host,' serving up hot water for hot chocolate and relaying messages to the lead teacher. And a final hint is to have one volunteer serve as the helper when it comes time to build the fire. I always have the fire building session take place within view of the headquarters area. If you can't find an extra adult for this position, the lead teacher can take on this challenge or the adult with each student group can do so.

Fire Building Notes & Hints

We use an item available from the Boy Scouts of America Supply Division called "Hot Spark." It cost under \$2 and works amazingly well. The Hot Spark is an easy to use form of flint and steel. The key to building a cooking fire is to keep it small. We only want the flame high enough to say "we did it," and to roast a marshmallow or two. We absolutely do not want a bonfire preferring small fires of about six to eight inches in height. After the fire has burned a few minutes we douse it completely and disassemble it; returning the area to its natural state. We build all the fires in the



same spot so as not to leave fire scars all over the mountainside. It is important for the success of this activity that the leader working with this activity, or your group leaders, know something about fire building. The key is to use the clothes dryer lint (that every student will be packing) as tinder, and have very tiny twigs as kindling, and finally pencil size sticks as fuel. I have students gather twigs and sticks and sort them according to size before ever making the first strike with the flint and steel.

As I've mentioned, I feel it is important to have the fire building activity take place in view of your headquarters so that you can maintain quality and safety. And the teacher should "certify" that the fire area is dead out and cleaned up before leaving for the day.

Activities:

Activities are to be completed as a group, though students need to record the group findings in his/her personal field journal. Groups can structure their day in any order, though you will be assigned a time to build your fire. Certain activities are required, others should be completed as time allows. Do your best on each activity. This is not a race.

NOTE: These activities are those we do based on our site. Most of these can be done just about anywhere. You will have to make final adjustments to suit your particular location.

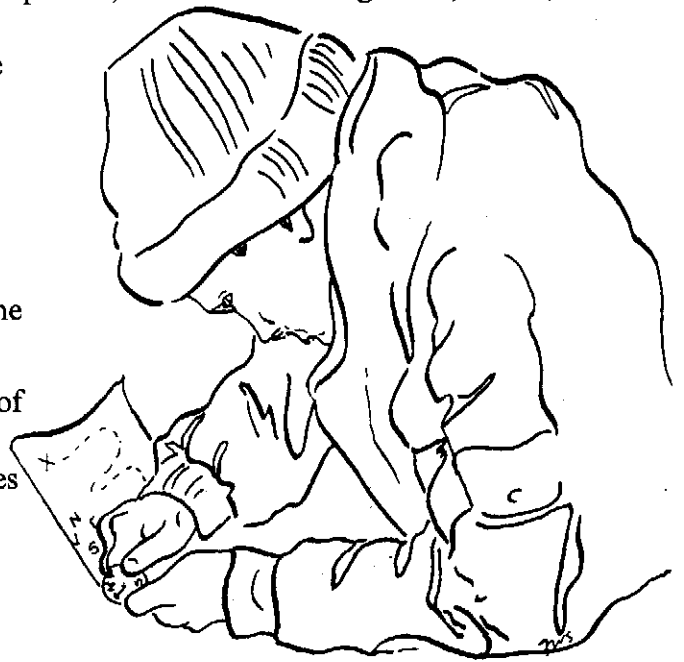
1. Map the old Gribley homesite. Design symbols for various features. Use a compass to get the directions correctly noted on your maps. Make accurate measurements of various features such as location of the possible cabin site, possible crop areas, sources of drinking water, creeks, and nearby natural features such as large trees, ravines, large rocks, etc. Make your map as accurate as possible so that another group could locate the features you've noted.

2. Locate the best water source for the Gribley homesite. Measure its distance to the homesite. Make sure to include this on the map. Can your group devise a way to get water from the source to the cabin site?

3. Identify four different trees. Estimate the height of each. Measure the circumference. Use a math formula to determine the diameter. Sketch these trees with names and measurements in your field journal.

4. Find the largest hemlock tree you can find. (Remember, Sam's home was in a hemlock.) Measure the circumference of this tree. Locate this tree's location on your site map. Determine if this tree would be large enough in which to build a home.

5. Build one simple camp tool or a piece of rustic wilderness furniture. Make sure all items for this are found on the ground and that you use only natural materials. Sketch in your field journal. Remember to disassemble your creation before leaving this area.



6. Find five signs of wildlife and sketch these in your journal. Be on the alert. Homes might be in the basement, ground floor, or canopy of any tree. They might be under something as well. But remember, it is absolutely critical that you not disturb anything and that everything gets placed back exactly as you found it! Note in your journal what you think lives in the homes you've found.

7. Build a simple animal trap. Sketch it in your journal. Trip your trap with a stick to see if it works. Make a note of what type of animal it is designed to catch. Where would you place it to be most successful?

Remember to completely dismantle this trap and return all of its components to the location where you found them. No one should be able to find where you built this trap when you're done.

8. Measure and record the air temperature in at least three different locations. Do this at least three times during the day - once within an hour of arriving, once at lunch, and the last time in the afternoon before departing.

9. Measure and record the water temperature of the creek in at least two places. Do this at least twice during the day. Careful - don't slip!

10. Get a fire started using flint and steel. Meet at _____ at _____ o'clock for this activity.

11. After completing at least five activities, take ten minutes off to reflect on what you have done so far and recap all of this in your journal.

12. Look for crayfish homes along the creek. Try not to step in the water.

13. Look for signs of other life around the creek such as tracks or homes. Sketch what you find in your journal.

14. Measure the velocity of the creek by dropping a small twig in at one spot and see how long it takes to reach another point. Record these findings in your journal.

15. Look for possible "cabin" sites for Sam and/or his family. Why do you feel you've found the perfect site? Note your findings in your journal.

16. Build a simple shelter big enough for one person out of materials you find on the ground. Sketch this shelter in your journal. Try it out for size. If you're brave, pour some water on top to see if it will withstand the forces of nature. When finished the shelter must be carefully dismantled and all parts returned to nature.

17. Locate a ravine and place its location on your map.

18. Give the creek and other places you discover a name and add these to your notes.

19. Find a spot for your group to be alone. Sit very quietly for 10-15 minutes and look and listen for signs of wildlife. List what you hear and see in your journal. You might want to try camouflage yourselves.

20. Look for edible plants. Don't eat them however.

Follow-Up Activities:

Once “My Side of the Mountain Day” is over teachers can use the experience for additional learning opportunities back in the classroom. Below are some suggested activities to get you started. These activities can serve as an excellent closure and assessment to the day long program.

1. Write a story of what you feel happened to the family that once lived at the site where we had our experience.
2. Write a summary of your day spent “on the mountain.”
3. Write a journal entry describing the “cold” or being out in the elements on a winter day. Make sure to include how you feel you would handle the first night out by yourself.
4. Would you want to live for a year like Sam? If a year is too long, what about a month or a week? Write why or why not as a journal entry.
5. In the novel, Bando keeps referring to Sam as a modern day Thoreau. Research Henry David Thoreau and write a report.
6. Write a letter to your parents telling them you are planning on spending a year in the woods by yourself. Give them reasons why you feel you are ready and capable for this experience.
7. Research the history of the land where we held our experience.
8. Build a model of the inside of a tree home like Sam’s.
9. Make a list of the skills you think you would need to “really” spend a year living like Sam. Where do you think you could learn those skills?
10. Read one how-to book on outdoor living.
11. Make a display of the work you did on “My Side of the Mountain Day.” Use the notes you made in your field journal.
12. Think of one or two other activities we should add to our activities list for next year.

In Closing

I hope you will find “My Side of the Mountain Day” to be as wonderful as we do. This program is a tremendous educational opportunity to bring learning outdoors. The added benefit of building team spirit by emphasizing cooperative learning is a definite plus. Kids and parents love this chance to be outdoors working together in this unique teaching environment. You will find this experience to be an outstanding way to build some excellent public relations for you and your school. The parents involved will come to understand how worthwhile special off-campus educational opportunities can be.

The excitement will continue as teachers let student groups share their discoveries and adventures of their special day during follow-up class discussions. The follow-up activities can help insure that the learning that took place on this day extends for weeks.

Start making plans now for your own version of “My Side of the Mountain Day.” It is sure to be one of the highlights of your school year.

The Author:

Mark Levin is a fifth grade teacher at the Carolina Day School in Asheville, North Carolina.

Literature Pathways to Science Processes

by Thomas O'Brien

Science problem solving/process skills and the skills of active reading overlap to a significant degree (Carter & Simpson, 1978; Riley, & Sowinski, 1979). Science processes are typically introduced at the beginning of the year and are then infused and used throughout the year in a variety of hands-on activities. Tradebooks that model these skills and/or call on children to employ them in the context of reading about science and scientists can reinforce the skills they develop by doing science. The synergistic effect of linking the two disciplines saves valuable instructional time and increases student motivation to read.

A fun way to introduce the wide variety of areas that scientists study, the related disciplines, and the idea that anyone can become a scientist is to use the tradebook:

What Are Scientists? (Gelman & Buxbaum, 1991). This delightful story revolves around invisible Martians who land on Earth to determine what scientists are and do. Poetry, rap, definitions & entertaining drawings provide the answer that scientists are ordinary people. After the broad field of science is presented, the following books used in conjunction with hands-on activities can be used to develop the various process skills used by scientists and everyday citizens in problem solving situations. Keep in mind that while any worthwhile science activity is likely to draw on all of these skills (and this list is not exhaustive), you may wish to focus students attention on one or two at a time.

Observing:

Backstein, K. (1992). ***The Blind Men and the Elephant***. NY: Scholastic. A retelling of the fable from India of the six blind men who observe an elephant from different, limited perspectives & draw very different impressions --

a wonderful metaphor for scientific discovery for all ages.

Geisel, Audrey (alias Theo.LeSieg). (1974). ***Wacky Wednesday***. NY: Random House/Beginner Books. Drawings & verse encourage careful observation & counting skills to identify the many things that are wrong in the illustrations.

Seymour, Peter. (1985). ***Animals in Disguise***. NY: Macmillan. 3-D/pop-up, Science Action book with movable parts depicting a variety of camouflage and defense mechanisms (10 pages).

Taylor, Kim. (1989). ***Secret Worlds: Too Fast to See, Too Small to See, Too Slow to See, & Too Clever to See***. NY: Bantam Doubleday Dell. Full-color photos (produced with special camera techniques) and text introduce plants and animals in ways not available to the unaided eyes (25 pages with index). Good books to use in conjunction with an introduction to scientific tools such as the microscope. See also: *Hidden: ...by Darkness, ...Inside, ...Underneath, & ...Under Water*.

Tillett, Leslie. (1980). *Plant and Animal Alphabet Coloring Book*. NY: Dover Publications. Activity and coloring book of 26 full page decorative letters containing an array of realistically drawn, yet hidden flora and fauna whose names begin with that particular letter (answer key included).

Wilson, A. (illus.) & Wood, A.J. (nature notes). (1990). *Look! The Ultimate Spot the Difference Book*. NY: Dial Books/Penguin. Paired full-color, realistic

drawings of twelve different ecosystems that challenge the viewer to spot the differences. End-of-book nature notes identify each animal and provide interesting facts.

Wood, John Norris. (1993). *Nature Hide & Seek: Rivers & Lakes*. NY: Knopf. Ten full-color, fold-out pages challenge readers to find hidden animals; in-between pages lists the total count plus color drawings & text on some of the animal species.

Classsifying:

Feldman, Judy. (1991). *The Alphabet in Nature*. Chicago: Childrens Press. Explores the alphabet thru full-color photos of animals & nature scenes that have the shape of a letter (contains no words).

Shapes in Nature. Wordless concept book that compares seventeen geometric shapes to similarly shaped full-color nature photographs. Both books are natural springboards to encourage children to examine other natural objects with an eye to classifying.

Measuring, Using Numbers and Recording Data:

Baum, Arline & Joseph. (1987). *Opt: An Illusionary Tale*. NY: Puffin Books/Penguin Group. Collection of 19 pages of optical illusions set in the context of a journey through a kingdom. Includes explanations & suggestions on how children can create their own illusions. Provides a motivational context for developing measuring skills to resolve some of the illusions.

Olney, Ross & Patricia & Alley, R.W. (illus.). (1984). *How Long? To Go, To Grow, To Know*. NY: William Morrow &

Co. Fascinating comparisons and two-color illustrations show how long it takes for various kinds of changes to occur (i.e., plants & animals to grow, distances to be traveled, objects to wear out, etc.).

Segan, Ann. (1979). *One Meter Max*. Englewood Cliffs, NJ: Prentice-Hall. Introduces the metric system with cartoon characters, rhyming text, and everyday comparisons and indirectly suggests a wide variety of measuring activities.

Predicting :

Guarino, Deborah & Kellogg, Steven (illustrator). (1989). *Is Your Mama a Llama?* NY: Scholastic. A baby llama alternately asks eight different animal friends the book's title question. Each animal gives him (and the child reader) a hint in the form of a riddle rhyme to help him guess what everyone's mother really is.

Koss, Amy G. (1987). *Where Fish Go in Winter and Answers to Other Great Mysteries*. Combines full-page artwork with fact-filled rhymes about 13 nature questions

(i.e., why does popcorn pop, leaves turn color, etc.). Poetry is delightful & scientifically accurate.

Norden, Beth B. & Ruschak, Lynette. (1993). *Magnification: A Pop-Up Lift-the-Flap Book*. NY, NY: Lodestar Books/Dutton Children's Books/Penguin Books. Contains 30 lift flaps & 3D scanning electron microscope photos (with color added) of everyday objects and organisms that encourage prediction, a sense of wonder and beauty.

Designing Investigations & Inventions:

Aaseng, N. (1989). *The Unsung Heroes: Unheralded People Who Invented Famous Products*. Minneapolis, MN: Lerner Publications. Archival photos & offbeat text tell story of such products as Coca-Cola, Hoover vacuum cleaners, pneumatic tires, McDonald's, etc..

Davidson, Margaret. (1990). *The Story of Thomas Alva Edison, Inventor: The Wizard of Menlo Park*. NY: Scholastic. Blend of history, adventure & science.

Gardiner, John Reynolds. (1984). *Top Secret*. Little, Brown & Co. A humorous story about a precocious nine year old boy who discovers the secret of human photosynthesis for his science project while working against the opposition of his teacher, Mrs. Green. (110pp./upper elementary). Fictional account of the "scientific method" and attitudes.

Haines, Gail Kay. (1990). *Micromysteries: Stories of Scientific Detection*. NY: G.P. Putnam's Sons. Describes thirteen historical case studies of scientific investigations involving the supersmall focusing on the scientists involved, the inquiry skills used, and the "products." (180pp./upper elementary-middle school: Goodyear & vulcanization, Hall & aluminum, Curie & radioactivity, Rocky Mountain spotted fever, Rutherford & nuclear model of atom, quantum model, diabetes, integrated circuits, etc.).

Harris, Tina et al. (1986). *Inventions and Discoveries*. Dominguez Hills, CA: Educational Insights.

BrainBoosters series activity book that stimulates creative thinking via questions about over 100 inventions -- comes with a hand-held Decoder that reveals the coded secret answers.

Mintz, Penny. (1989). *Thomas Edison: Inventing the Future*. NY: Fawcett Columbine/Ballantine. 120 page biography for upper elem-middle school.

Moore, Eva. (1990). *The Story of George Washington Carver*. NY: Scholastic. Easy-to-read biography of famous black scientist..

Quackenbush, Robert. Historical biography series for grades 2-5. Titles include: *Ahoy!*

Ahoy! Are You There? (Alexander Graham Bell), *The Beagle and Mr. Flycatcher* (Charles Darwin), *Here a Plant, There a Plant, Everywhere a Plant* (Luther Burbank), *Oh, What an Awful Mess!* (Charles Goodyear), *Quick, Annie, Give Me a Catchy Line!* (Samuel Morse), *Watt Got You Started, Mr. Fulton* (James Watt & Robert Fulton), *What Has Wild Tom Done Now!!!?* (Thomas Alva Edison): NY: Simon & Schuster.

Interpreting Data, Creating Models & Inferring

Cole, Joanna & Meisle, P (illus.). (1993). *Your Insides*. Uses playful, cartoon-like pictures (and four transparent pages) and questions that require simple, self exploratory actions on the part of the child to explain how different body parts work.

Jones, Frances. (1992). *Nature's Deadly Creatures: A Pop-Up Exploration*. NY: Dial Books for Young Readers/Penguin Books. Two pages of text, full color photos/drawings & dramatic 3D figures for each of the following: scorpion fish, black widow spider, scorpion, king cobra, Gila monster, & blue-ringed octopus.

Lauber, P. (1990). *How We Learned the Earth is Round*. NY: Let's-Read-and-Find Out Science Book/Thomas Crowell. 32

page book addresses the history of the question from ancient times to photos of spaceship earth.

Macaulay, D. (1979). *Motel of the Mysteries*. Boston: Houghton Mifflin. A future amateur archeologist discovers clues to the lost civilization of ÒUsaÓ from a supposed tomb, Room #26 at the hotel of the Mysteries. This book is an extended, insightful & humorous allegory for the power and pitfalls of logically constructed inferences based on incomplete evidence.

Seymour, S. & de Groat, D. (illus). (1979). *Animal Fact/Animal Fable*. NY: Crown. Contrasts fables vs facts (includes humorous vs realistic sketches) for twenty animals.

Resources/References:

- Carter, G.S. & Simpson, R.D. (1978). Science and reading a basic duo. *The Science Teacher*, 19-21.
- Gelman, R., & Buxbaum, S. (1991). *What Are Scientists?* NY: Scholastic.
- Riley, J. & Sowinski, K.D. (1979). Natural partners: Science and reading. *Science and Children*, 46.

The Author:

Thomas O'Brien, Ph.D., is a professor of education at the State University of New York, Binghamton.

Integrated Whole Language & Science: A Dynamic Duo

by Thomas O'Brien

Appendix A

Philosophical & Psychological Assumptions or Why Should Language Arts and Science be Integrated?

Elementary teachers faced with the dual constraints of limited instructional time and material resources may find some solace and important curriculum design implications in cognitive psychology research. Specifically, advocates of whole language and constructivist science teaching will find common ground in the following position statements:

1. Learning is a natural, joyful, empowering process that occurs even in the absence of formal instruction. Learning typically involves much more than imitation and rote memorization; it entails the active construction of meaning.
2. Quality instruction capitalizes on children's natural curiosity, "will to know," and desire to be active. Hands-on "doing" activities are crucial for activating children's prior knowledge and building a common experiential base for minds-on reflective construction of knowledge in a social context. Or as the Council for Basic Education puts it:

"Basic education without science is inconceivable" (Bulletin No.23, June 10, 1979, p.2).
 "There is impressive evidence that hands-on science increases achievement in reading and math in early grades" (Occasional Papers, No.24, 1976, p.40).

3. Errors or "miss-takes" are a sign of effort and approximations to proficiency, not signs of personal failure. Risk-taking behaviors such as making predictions based on hunches should be encouraged in both language arts and science instruction. Development of process and problem solving skills also simultaneously encourages the attitudes of curiosity, objectivity, open-mindedness, inventiveness and persistence.
4. Oral and written language forms are based on interactive "conversations" that have as their focus communication about "something" and are therefore most naturally learned through use in authentic, "meaning-full" situations. Experience-based science provides a functional and fun context for active listening, speaking, reading and writing as a means to clarify thinking and exchange ideas. Accordingly, language arts do not necessarily have to be considered as separate subjects that demand special textbooks (i.e. basal readers); they may be integrated into all content areas on a "need-to-use" basis. This is, in fact, the position taken by the U.S. Department of Education's Commission on Reading 1985 report *Becoming a Nation of Readers*:

"the most logical place for instruction in most reading and thinking strategies is in social sciences and science rather than in separate lessons about reading."

5. Many language arts and science instructional "failures" are due to decontextualized, "drill-and-kill" approaches. It is not necessarily true that if it is possible to identify "prerequisite" subskills for a complex activity, performance (the "whole") will be enhanced by teaching skills as isolated "parts." Learning is a developmental and somewhat idiosyncratic process; it does not follow a preconceived hierarchical sequence of skills.

Whole language and hands-on/minds-on approaches to science respect the holistic nature of children, learning, and knowledge by acknowledging that the primary role of teacher instruction is to promote the learner's active construction of meaning. Clearly, integrating elementary language arts and science forms a natural, dynamic duo!

Appendix B

Curriculum & Scheduling Integration Options or How Can Language Arts and Science be Integrated?

A "minds-on," sense-making approach to learning is violated by many basal readers and elementary science textbooks which emphasize memorization of isolated skills, words and facts. Certainly, improved textbooks would go a long way towards addressing this problem, but with or without textbook changes individual teachers can move their instruction in this direction by changing how they block instructional time. On the conventional end of the scheduling continuum, schools allot separate, distinct time slots and/or different teachers for different subject areas without direct attempt to show interdisciplinary connections. Beyond the previously discussed problems, this approach helps insure that science is relegated to one or two, twenty minute segments per week. Most likely, activity-based strategies will not be used since the time needed for materials setup and cleanup could use up a significant portion of the total instructional time allotted.

At the other end of the continuum, students would experience an integrated curriculum with time allocated according to the needs of students and tasks, not institutional demands. If the entire program is arranged this way, demarcations between real world problems and issues and the school would be minimized. Unfortunately, as this approach requires full school participation, it is not a short-term option for most teachers. In between these extremes, most teachers with perhaps minimal participation from their same grade level peers can begin to integrate their instruction in one of two ways. If it is desired to maintain separate subject areas and scheduling blocks, teachers can run their units in a parallel, multi-disciplinary fashion. Alternatively, interdisciplinary units could be designed around common skills and mental processes, concepts, and themes selected by the teacher and initiated by shared, real-world, problem solving activities.

The latter approach is consistent with recommendations by such groups as the American Association for Advancement of Science (AAAS Project 2061), the National Council of Teachers of Mathematics (NCTM Curriculum Standards), and the National Science Teachers

Association (NSTA Scope, Sequence & Coordination Project). The savings in terms of instructional materials (i.e. dollars saved from not using basal readers can be diverted into hands-on materials) and time and the dividend of enhanced motivation and learning, make the initial investment of planning time well worth the effort.

Potential pitfalls for teachers attempting to integrate the teaching of science and the language arts include: (1) The instructional time allotted to science could be further eroded by dilution or substitution rather than true integration. Reading about science, while a useful supplement to, is not a replacement for, doing science. (2) The curriculum could become driven by "fun" activities rather than carefully selected "mental" goals. The recently published AAAS Project 2061 Benchmarks and the forthcoming National Research Council's National Science Standards can be used to identify the "FUNdaMENTALS." (3) Selecting high quality children's tradebooks and science magazines and designing integrated lessons around them is a time-consuming process. Fortunately, a variety of sourcebooks (beyond the present volume), science magazines, and annotated bibliographies of science-related tradebooks are available to aid overworked teachers (see the lists that follow). Perhaps with the help of such resources, we can come closer to opening our students' minds to John Muir's holistic vision: "When we try to pick out anything by itself we find it hitched to everything else in the universe."

Resources for Integrating Science & Language Arts

- Braddon, Kathryn L., Hall, Nancy J., and Taylor, Dale. (1993). *Math Through Children's Literature Making the NCTM Standards Come Alive*. Englewood, CO: Teacher Idea Press.
- Brainard, A. H. & Wrubel, D. H. (1993). *Literature-Based Science Activities Activities: An Integrated Approach*. New York: Scholastic, Inc.
- Butzow, Carol M., and Butzow, John W. (1989). *Science Through Children's Literature An Integrated Approach*. Englewood, CO: Teacher Ideas Press. (240 pp).
- Butzow, Carol M., and Butzow, John W. (1994). *Intermediate Science Through Children's Literature Over Land and Sea*. Englewood, CO: Teacher Ideas Press.
- Freedman, Robin Lee Harris. (1990). *Connections: Science by Writing*. Carmichael, CA: Serin House (available thru the National Science Teachers Assn.).
- Freeman, Judy. (1992). *Books Kids Will Sit Still For*. New York: R. R. Bowken.
- GEMS. (1993). *Once Upon a GEMS Guide*. Berkely, CA: Lawrence Hall of Science.
- Great Explorations in Math and Science/GEMS. *Once Upon a GEMS Guide: Connecting Young People's Literature to Great Explorations in Math and Science*. 376 pages. LHS GEMS, Lawrence Hall of Science, University of California, Berkeley, CA 94720. 510-642-7771. GEMS also publishes a variety of teacher activity guides.
- Great Plains National/GPN, University of NE-Lincoln, Box 80669, Lincoln, NE 68501. 800-228-4630. ETV organization sells: *Science Comes Alive with Reading Rainbow Teacher's Guide* (\$5).
- Kobrin, B. (1988). *Eyeopeners!* New York: Penguin (new book due in 1995).
- Levinson, Elaine. (1994). *Teaching Children About Life & Earth Sciences*. New York: TAB Books.
- Levinson, Elaine. (1994). *Teaching Children About Physical Sciences*. New York: TAB Books.

Spann, Mary Beth. (1991). *Literature-Based Seasonal and Holiday Activities*. New York: Scholastic Professional Books.

Bibilographies of Science Trade Books for Children

Book Links. Bimonthly publication of BookList Publications, American Library Assn., 50 E. Huron St., Chicago, IL 60611 (new subscriptions: PO Box 1347, Elmhurst, IL 60126; 800-545-2433 or 1545; \$18/yr).

Outstanding Science Trade Books for Children. Children's Book Council, 568 Broadway, NY, NY 10012. 212-966-1990. (also in March issue Science & Children)

Science Magazines for Children

Children's Television Network, One Lincoln Plaza, NY, NY 10023. *3-2-1 Contact* (grades 3-6). 10 issues/yr.

The Author:

Thomas O'Brien, Ph.D., is a professor of education at the State University of New York, Binghamton.
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CESI provides a variety of resources in an effort to promote quality preschool-elementary science education. The intended audiences are classroom teachers, resource staff, supervisors, administrators, research personnel, and methods instructors. These resources include:

- Sessions at international, national, state and local science teacher conferences and meetings. Presenters include nationally recognized experts in the field of elementary science education and classroom practitioners who share hands on materials, research data, classroom activities, and inservice suggestions.
- A Quarterly newsletter offering teaching suggestions and updates on current issues in preschool-elementary science education.
- Sourcebooks written on specific science topics of interest to preschool-elementary practitioners.
- Awards programs to recognize exemplary elementary science teachers, teachers new to our profession, and principals who are supportive of elementary science instruction.
- International projects to provide global perspectives and methods for sharing of mutual interests/concerns.
- Directory of members, those people who have been identified as having an interest and voice in preschool-elementary science.
- Award winning monographs and occasional papers on issues of specific interest to elementary science educators and those interested in promoting quality elementary science education.
- Positions on issues, spokesman for preschool-elementary science education.
- A forum for educators to voice their opinions, share their ideas, and develop a professional comradery with those having similar interests and needs.
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Science Experiences for Preschoolers
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Water Stones and Fossil Bones
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Through the Rainbow Children, Science, and Literature
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To Order contact:

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Monographs Monographs are prepared as professional pieces that provide current insights to the practitioner. They are researched and written by national leaders in elementary science education.

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